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Are Business Cycles Different in Asia and Latin America?

Prepared by Alexander W. Hoffmaister and Jorge E. Roldós[1]

Authorized for distribution by Peter Wickham and Donald J. Mathieson

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Abstract

This paper compares business cycles in Asia and in Latin America using structural vector autoregression analysis with panel data. The evidence for countries in these regions suggests that (i) the main source of output fluctuations is supply shocks, even in the short run; (ii) the real exchange rate is driven mostly by fiscal shocks; and (iii) terms of trade shocks are important for trade balance fluctuations but not for output or real exchange rate fluctuations. However, in Latin America, as opposed to Asia, output is affected more by external and domestic demand shocks.

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Authors' E-Mail Addresses:
ahoffmaister@imf.org
jroldos@imf.org

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SUMMARY

Understanding business cycles is the first step in designing appropriate stabilization policies Although there is no a priori reason to think that business cycles are different in industrialized and developing countries, the faster growth and greater volatility in developing countries, combined with the recent emphasis in the literature on the connection between trends and cycles, suggests that there could be some interesting differences.

This paper compares the properties of the business cycles in Asia and in Latin America using a structural vector autoregression approach that encompasses equilibrium and disequilibrium views of the business cycle. The paper thus seeks to further our understanding of the relative importance of the different factors or shocks that drive business fluctuations in the developing countries. The methodology used allows the documentation of the dynamic impact of these shocks on key macroeconomic variables (output, real exchange rate, trade balance, and prices) in a framework that simultaneously considers shocks emanating from the global environment (world interest rates, and terms of trade) and those of domestic origin (supply, fiscal and nominal).

The evidence for the developing countries in Asia and in Latin America suggests that, as in many industrialized countries: (i) the main source of output fluctuations is supply shocks, even in the short run; (ii) real exchange rates are mostly driven by fiscal shocks; and (iii) terms of trade shocks appear to play a small role in output and in real exchange rate fluctuations but are important determinants of the trade balance. The paper also suggests that developing countries in these two regions differ, in Latin America external shocks--in particular world interest rate shocks--and demand shocks affect output fluctuations more than in Asia. Nominal shocks appear to affect these developing countries differently but in general play a small role in GDP and in real exchange rate fluctuations.

I. INTRODUCTION

Understanding business cycles is the first step in designing appropriate stabilization policies (Lucas, 1977). Although there is no a priori reason to think that business cycles are different in industrialized and developing countries, the faster growth and greater volatility in developing countries combined with the recent emphasis in the literature on the connection between trends and cycles, suggests that there could be some interesting differences. The objective of this paper is to compare the properties of the business cycles in Asia and in Latin America using a structural VAR approach that encompasses equilibrium and disequilibrium views of the business cycle. We also compare our results to the evidence for industrial countries.

The macroeconomic experience of the developing countries in Asia and in Latin America during the past 25 years has differed markedly both in terms of long–term growth and the business cycle (see Table 1). Output growth in Asia has been twice that of Latin America and has been more stable. Similarly, inflation has been substantially lower and more stable in Asia than in Latin America. In Asia the trade balance (as measured by the ratio of absorption to output) has been relatively unchanged while in Latin America it worsened on average and it has been less stable. This has coincided with the fact that terms of trade and real exchange rates have also been more stable in Asia than in Latin America.

These and other stylized facts have stirred the interest of numerous researchers and it is not surprising that a number of comparative studies have discussed these differences. Most of the studies focus on particular aspects of growth or structural adjustment (see amongst others Sachs (1985) and Edwards (1994)), while other studies emphasize the different nature of and policy responses to capital inflows in Asia and Latin America (see Calvo, Leiderman and Reinhart (1994), Frankel (1994), Reisen (1993), and Schadler et al (1993)). More recently, Mendoza (1995) focuses on the role of terms of trade shocks on business cycles using a developing country "benchmark" based on countries both in Asia and in Latin America, as well as other developing countries. Another recent study by Hausmann and Gavin (1995) stresses the importance of the volatility of external and policy factors to understand the relatively less successful growth performance and income distribution in Latin America.

This study seeks to further our understanding of the relative importance of the different factors or shocks that drive business fluctuations in the developing countries of Asia and Latin America and to document the dynamic impact of these shocks on key macroeconomic variables, by considering simultaneously the most relevant shocks considered in the studies mentioned above. This allows us to control for individual effects and thus, the

Table 1. Asia and Latin America, Stylized Facts 1971-93

(Annual percent change, unless otherwise noted)

	Terms of Trade		Output		Real Exchange Rate		Absorption/Y		Prices	
	Asia	Latin America	Asia	Latin America	Asia	Latin America	Asia	Latin America	Asia	Latin America
Mean	-0.7	-0.5	5.7	3.1	-0.2	0.6	--	0.2	8.7	43.2
Standard Deviation	12.0	16.4	4.2	5.0	9.5	26.3	3.2	5.0	7.5	72.5
Coefficient of Variation	17.3	30.5	0.7	1.6	45.8	47.1	64.6	29.3	0.9	1.7
Shock	1.3	2.3	0.1	0.2	0.6	6.5	0.1	0.2	0.7	15.8

Note: The shocks are the standard error (multiplied by 100) of the reduced-form innovations of the VAR models detailed in Appendix Tables A2 and A3. The countries included in each region are noted in Appendix Table A1.

analysis would be better suited to separate and to distinguish between the effects of each shock and provide a better measurement of their relative importance.[2]

To do this we develop a small open economy version of the structural vector autoregression (SVAR) model proposed by Blanchard and Quah (1989) and Shapiro and Watson (1988). The SVAR model adds economic restrictions to an otherwise statistical model to identify the sources of macroeconomic fluctuations. In this paper these restrictions are motivated by a two–sector small open economy model with imported intermediate inputs in the spirit of Bruno and Sachs (1985). To the usual restrictions that constrain aggregate demand shocks to have no effect on output in the long run, we add the restriction that fiscal shocks affect the composition of output—through its impact on the real exchange rate—but not the level of aggregate GDP. A set of block–exogeneity restrictions that stem from the small open economy assumption is also used. An interesting feature of this methodology is that the short–run dynamics are determined by the data without the need to spell out the particular frictions emphasized by different macroeconomic paradigms.

This paper differs from our previous work (see Hoffmaister and Roldós (1996)) in four respects. First, we include trade in international financial markets in the model so that world interest rate shocks are a source of business cycles in these economies. Second, we exploit the dual impact that shocks have on the real exchange rate and the trade balance. This is done by estimating two empirical models for each region where the domestic variables differ: Model 1 contains output, the real exchange rate and prices while for Model 2 the real exchange rate is replaced with the trade balance. The dual nature of the real exchange rate and the trade balance in general equilibrium precludes the identification of meaningful shocks that affect one but not the other. Moreover, the results from these two models provide a simple robustness check of the identification of shocks and their effects on the main macroeconomic variables. Third, we check the robustness of the role of nominal shocks by means of changing the nominal variable included in the SVAR. And fourth, we use two sets of panel data for 15 Asian and 17 Latin American countries, with annual data from 1970 through 1993. This allows us to take advantage of both the cross–sectional and time–series information to improve the measurement of the sources of business fluctuations and the dynamic responses in these regions.

The evidence for the developing countries in Asia and in Latin America suggests that, as in many industrialized countries: (i) the main source of output fluctuations are supply shocks, even in the short run; (ii) real exchange rates are mostly driven by fiscal shocks. In contrast with Mendoza (1995), our results suggest that terms of trade shocks play a small role in output and in real exchange rate fluctuations but are important determinants of the trade balance, i.e., we find evidence of the Harberger–Laursen–Metzler effect.

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[2]Note that the focus of this paper is not on the determinants of trend or long–run growth in Asia or in Latin America.

Amongst the differences between these developing countries, the evidence suggests that in Latin America external shocks--in particular world interest rate shocks--and demand shocks affect output fluctuations more than in Asia. Also, nominal shocks appear to affect these developing countries differently but in general play a minor role in GDP and in real exchange rate fluctuations.

The remainder of the paper is organized as follows. Section II provides a brief description of the two–sector small open economy model that underlies the long–run economic restrictions, and discusses the empirical strategy used in this study. Section III presents the main empirical evidence that characterizes the macroeconomic fluctuations for Asia and Latin America with the variance decompositions and impulse–responses estimated from the SVAR model. Section IV provides additional discussion on the evidence regarding the small role played by nominal shocks in explaining output and real exchange rate fluctuations. Section V provides evidence that the fiscal shock identified by the SVAR model is in fact associated with government spending. The final section summarizes the results highlighting the differences and similarities of the business cycles in Asia and Latin America and compares these findings with the available evidence for industrialized countries.

II. Modeling Macroeconomic Fluctuations in Small Open Economies

To model the macroeconomic fluctuations in the developing countries, we follow the structural vector autoregression (SVAR) analysis proposed by Blanchard and Quah (1989), Shapiro and Watson (1988), and extended to large open economies by Ahmed et al. (1993) and Clarida and Gali (1994). The SVAR analysis uses a set of long–run economic restrictions that are added to the purely statistical restrictions of a VAR. To derive these long–run economic restrictions, we consider a general equilibrium version of the small open economy model presented in Dornbusch (1989) as a benchmark for examining real exchange rate determination in developing countries. While using the same production structure as Hoffmaister and Roldós (1996), we extend the set of assets available in the economy allowing for trade in financial assets with the rest of the world. This extension allows us to discuss the role of the exogenous world interest rate as a source of business fluctuations, and provides a framework in which other shocks, namely terms of trade, supply, fiscal, and nominal shocks, are jointly identified and quantified. The description of the model that follows focuses on the long–run effects of these shocks on output, the real exchange rate and the trade balance, as the short–run dynamics are left to be determined by the data. This economic model motivates the long–run identifying restrictions that, together with the usual assumption of orthogonality of structural innovations, identify the structural innovations and helps to interpret the empirical results presented in Section III.

A. Output

Consider a small open economy that produces an exportable and a nontradable good. The exportable good sector uses capital (K) and labor (L_x) as well as an imported intermediate input (M) to produce an amount of gross output given by:

$$Q_{x_t} = A_{x_t} [K_t^{1-\alpha} L_{x_t}^{\alpha}]^{\mu} M_t^{1-\mu} = A_{x_t} V_{x_t}^{\mu} M_t^{1-\mu} \qquad \textbf{(1)}$$

where A_x is the level of the technology. A convenient way to summarize the production side is by means of a real value added function, Y_x, that subtracts the optimal choice of intermediate inputs from gross output (see Bruno and Sachs (1985)):

$$Y_{x_t} = [\mu (1-\mu)^{(1-\mu)/\mu}] \; A_{x_t}^{1/\mu} \; P_{m_t}^{(\mu-1)/\mu} \; V_{x_t} \qquad \textbf{(2)}$$

where P_m is the domestic price of intermediate inputs in terms of the exportable good, i.e., inclusive of the tariff rate. To complete the supply side of the model, the production of the nontradable good is assumed to use only labor (L_n) as an input,

$$Q_{n_t} = Y_{n_t} = A_{n_t} L_{n_t}^{\beta} \qquad \textbf{(3)}$$

Although this specification is somewhat restrictive, it captures the relative labor intensity of this sector and the fact that the share of intermediate inputs used in the nontradable sector is much smaller than that used in the tradable sector. This specification, nonetheless allows for the existence of some nonreproducible factors in the nontradable sector (see Roldós (1995)) such that fiscal shocks can lead to a permanent real exchange rate appreciation.[3]

In order to discuss the effects of the different shocks on *total* GDP, $Y_t = Y_x + QY_n$, we need to use an expression for the real exchange rate Q, that equates the relative price of nontradables to the ratio of the marginal products of labor in each sector:

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[3]Dornbusch (1989) sketches a model that stresses similar features as a useful paradigm for modeling real exchange rates in developing countries. See, however, Guidotti (1988), Engel and Kletzer (1989) and Obstfeld (1989) for models where capital mobility leads to a constant real exchange rate.

$$Q\ \beta A_n (L - l_x K)^{\beta - 1} = \alpha B\, l_x^{\alpha - 1} \qquad \textbf{(4)}$$

where $l_x = L_x/K$ is the inverse of the capital/labor ratio in the tradable sector and $B = \mu\ A_x^{1/\mu}\ [(1-\mu)\ p_m^{-1}]^{(1-\mu)/\mu}$ is a function of parameters and exogenous variables. Defining s_n to be the share of nontradable output in total output and λ_n the share of nontraded sector labor in total labor, and using lower–case letters to denote the logs of upper–case variables, total GDP can be expressed as:

$$y_t = \Phi + (1/\mu)\, a_{x_t} - \left(\frac{1-\mu}{\mu}\right) p_{m_t} + (1 - s_n/\lambda_n) \log K_t + (\alpha - s_n/\lambda_n) \log l_x \qquad \textbf{(5)}$$

Equation (5) will be useful to illustrate the factors that determine the long–run (log) level of output. Ignoring the constant, the first two terms are exogenous shocks while the last two terms are endogenous variables that respond to these and other shocks.

The first two terms in equation (5) are supply shocks that enter symmetrically. Bruno and Sachs (1985) pointed out that this is because an increase in the price of intermediate inputs acts like negative technological progress. Moreover, the second term can be decomposed into the world price of intermediate inputs, p_m*, and the tariff rate, τ. This allows us to model supply responses to structural reforms such as trade liberalization (see Lee (1993)) as well as the impact of terms of trade shocks. In general, an improvement in the terms of trade and/or a structural reform that removes distortions leads to a positive response in total GDP.

To introduce demand shocks, we assume that government spending falls mostly on nontradable goods. Equilibrium in the market for nontradables implies that:

$$C_n = Y_n (1 - g) \qquad \textbf{(6)}$$

where C_n denotes private consumption of nontradables and g is the share of public consumption relative to nontradable output. Individuals in this economy have access to international capital markets, where they borrow an amount D at the world interest rate r*.[4] In the steady state, there is no change in net external debt implying that:

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[4]We are assuming that individuals have time–separable constant rate of time preference utility functions and that the rate of time–preference equals the world interest rate.

$$Y_x - r*D = C_x \tag{7}$$

i.e., tradable output net of interest payments equals consumption of tradable goods.

The main effect of a fiscal expansion in this model is to change the *composition* of demand—and hence production—towards nontradable goods, with an ambiguous effect on *total* GDP.[5] As is shown in Appendix I, for standard parameter values an increase in g leads to a decline in the capital stock. This decline has an ambiguous effect on total GDP as is clear in equation (5). In the benchmark case, where the share of labor in the nontradable sector is similar to the share of nontradables in total output ($s_n/\lambda_n = 1$), GDP is unchanged despite the decline of the level of the capital stock because the labor/capital ratio, l_x, is determined by the world interest rate. Given this ambiguity, we do not impose a sign on the long–run impact of fiscal policy on GDP, rather we assume that it is small and not very different from zero (as s_n/λ_n is not very different from 1).[6]

Finally, the fourth term in equation (5) captures the effect of world interest rate shocks because in the long run the marginal productivity of capital equals the world interest rate

$$B(1-\alpha)l_x^{\alpha} = r^* \tag{8}$$

under perfect capital mobility. An increase in world interest rates tends to have a contractionary effect on total GDP as the increase in the labor/capital ratio is multiplied by a negative coefficient in equation (5).

B. Real Exchange Rate and the Trade Balance

The dual nature of the short–run responses of the real exchange rate and the trade balance is well understood: excess demand pressures lead to real exchange rate appreciation and trade deficits. The simple model that we are considering yields straightforward responses to most of the shocks considered in this study, in particular, the long–run responses preserve

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[5]A fiscal expansion could also entail an increase in distortionary taxes that would tend to reduce total output in the long run (see Ahmed, et al. (1993)).

[6]More importantly, in connection with the empirical strategy used in this study, Blanchard and Quah (1989) demonstrate that the identification of the shocks is robust provided that the effect of fiscal policy on long–run output is small relative to the long–run effects of other shocks.

the dual nature of the short–run responses and hence provide a natural interpretation of the empirical evidence in Section III.

The long–run response of the (log) real exchange rate, q, to the different shocks (the relative price analog to equation (5)) is as follows:

$$q_t = \Phi_q + (1/\mu)a_{x_t} - a_{n_t} - \left(\frac{1-\mu}{\mu}\right) p_{m_t} - (1-\beta)\left(\frac{1-\lambda_n}{\lambda_n}\right) \log K_t - \left[(1-\alpha) + (1-\beta)\left(\frac{1-\lambda_n}{\lambda_n}\right)\right] \log l_{x_t} \qquad \textbf{(9)}$$

A positive supply shock, due either to technological progress in the tradable sector or to trade liberalization, as well as a terms of trade improvement, leads to a real exchange rate appreciation under plausible parameter values (see Hoffmaister and Roldós (1996)). This is due to the fact that positive wealth effects of these shocks lead to a higher demand for nontradables that is met by a reallocation of labor to the nontraded goods sector induced by the increase in the relative price of the nontraded good.

An increase in government spending also leads to a real exchange rate appreciation. Despite having a negative wealth effect, the fact that government spending is biased towards nontradable goods requires an increase in the relative price of the nontraded good to reach a new equilibrium. The fiscal expansion leads to a decline in the capital stock, that has a first order effect on the real exchange rate, but a negligible effect on the level of total GDP (this is apparent from a comparison of the coefficients of log K in equations (5) and (9)). In Appendix I it is shown that under general parameter assumptions the response of the real exchange rate is more than twice that of GDP.

The impact of the different shocks on the long–run level of the trade balance is easily established by exploiting the fact that in the long–run the trade balance equals the factor service (or income) account balance. In other words, from equation (7) it follows that the (log of) trade balance (TB) is given by

$$\log TB_t = \log(Y_x - C_x) = \Phi_{tb} + \log r*_t + \log K_t \qquad \textbf{(10)}$$

where we used the fact that in the long–run domestic capital and net foreign assets are perfect substitutes. A permanent fiscal expansion causes a reduction in the trade surplus as the decline of the capital stock leads to a lower steady–state level of external debt. An increase in world interest rates leads to a larger trade surplus, as the fall in domestic absorption relative to output accommodates the increased interest payments.

C. Nominal Variables

Following the common practice in the literature on the sources of business fluctuations, we assume long–run neutrality of money and/or the nominal exchange rate.[7] To capture the role of nominal variables in the short run, the structural model includes a general unspecified equation for the evolution of the price level. Owing to the different exchange rate regimes followed by the sample of countries considered in this study, it is difficult to establish whether the evolution of the price level is determined by the money supply, the nominal exchange rate, or both. It is, nonetheless, likely that the inflation rate will be affected by the other variables of the economic system, either via a direct effect through money demand or through some feedback rule the authorities follow on the chosen nominal anchor.[8]

D. Identification and Estimation

The SVAR model that is used to obtain the main empirical results of this paper, summarizes both the extrinsic dynamics of the exogenous variables, as well as the intrinsic dynamics—or propagation mechanisms—of the model. For the discussion that follows, it will be useful to summarize the exogenous variables of the model in a vector $z_t' = [r^*, p^*_m, \tau, g, n]$, where r^*, p^*_m, τ, g, and n are respectively the world real interest rate, the terms of trade, the import tariff rate, government spending and the nominal anchor/instrument used by the authorities. The exogenous variables are assumed to have an MA representation given by $\Delta z = B(L)\epsilon$, where B(L) is a general lag polynomial matrix that summarizes an unspecified stochastic process driving the exogenous variables, and $\epsilon' = [\epsilon^{i*}, \epsilon^{tt}, \epsilon^{s}, \epsilon^{f}, \epsilon^{n}]$ contains the respective structural innovations. These structural innovations are assumed to be serially uncorrelated with mean zero and are mutually orthogonal, that is $E[\epsilon\epsilon'] = I$.

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[7]Roldós (1993, 1995) and Uribe (1995) show how a successful stabilization can lead to a permanent output expansion, and Easterly (1996) provides evidence in favor of this hypothesis. Thus, the assumption that nominal shocks are neutral in the long–run may underestimate the importance of nominal shocks in explaining output fluctuations, particularly for high inflation countries that in this study are concentrated in Latin America. Nonetheless, Blanchard and Quah (1989) note that the identification process is robust even when the effect of nominal shocks is not zero but small compared to the effect of real shocks.

[8]This study does not attempt to separately identify nominal shocks, as in Gali (1992) where demand and the money supply shocks as distinct sources of the business cycle. In the next section, however, we use alternative nominal variables (the nominal exchange rate and M1) to identify nominal shocks and check the robustness of the empirical evidence.

The reduced form SVAR model can then be expressed as:

$$\begin{bmatrix} \Delta r^* \\ \Delta p^*_{m_t} \\ \Delta y_t \\ \Delta q_t \\ \Delta p_t \end{bmatrix} = A(L) \times \begin{bmatrix} \epsilon_t^{i*} \\ \epsilon_t^{tt} \\ \epsilon_t^{s} \\ \epsilon_t^{f} \\ \epsilon_t^{n} \end{bmatrix} \qquad \textbf{(11)}$$

where the left–hand side of equation (11) contains the endogenous variables (domestic output, the real exchange rate, and the price level) and A(L) is a square matrix of lag polynomials. The typical element of A(L), $a_{ij}(L)$, denotes the response of the i^{th} endogenous variable to the j^{th} structural innovation lagged L periods. Note that this response depends both on the dynamics of the exogenous variables z_t summarized by B(L) and the unspecified intrinsic dynamics of the model. Thus, the short–run movements of output, the real exchange rate and prices can be interpreted either as the result of transitional equilibrium dynamics of capital accumulation and labor supply in response to the different shocks, or as the disequilibrium dynamics implicit in a model with wage/price stickiness. Rather than assuming a particular macroeconomic paradigm, the empirical methodology allows the data to determine the short–run dynamics implied by A(L).

The estimation strategy used in this study to recover the structural innovations is an extension of Blanchard and Quah (1989) and Shapiro and Watson (1988). This strategy relies on long–run economic restrictions and thus avoids the contemporaneous ordering restrictions of standard VAR analysis, see Sims (1980). Blanchard and Quah show that the structural innovations are a linear transformation of the reduced–form innovations and this linear transformation requires identifying the matrix of contemporaneous effects of the structural innovations, A(0).[9]

In this study three types of restrictions are used to identify the 25 elements of the matrix A(0): (i) the small open economy assumption; (ii) the long–run economic restrictions from the theoretical model; and (iii) the orthogonality of the structural innovations.

The first type of restrictions is derived from the small open economy assumption, and implies that domestic innovations do not effect external variables, i.e., world interest rates and terms of trade. These restrictions correspond to the zeros in the north–eastern quadrant of the long–run multipliers matrix:

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[9]A brief discussion of SVAR identification is contained in Appendix II.

$$\mathbf{A(1)} = \left[\begin{array}{cc|ccc} a_{11}(1) & 0 & 0 & 0 & 0 \\ a_{21}(1) & a_{22}(1) & 0 & 0 & 0 \\ \hline a_{31}(1) & a_{32}(1) & a_{33}(1) & 0 & 0 \\ a_{41}(1) & a_{42}(1) & a_{43}(1) & a_{44}(1) & 0 \\ a_{51}(1) & a_{52}(1) & a_{53}(1) & a_{54}(1) & a_{55}(1) \end{array}\right] \qquad \mathbf{(12)}$$

Ahmed and Park (1994) also use the small open economy assumption but fail to impose it in the short run. To overcome this problem this study imposes the small open economy assumption by specifying the block exogeneity of ϵ^{tt} and ϵ^{i^*}, that corresponds to $a(j)_{ik} = 0$ for $i= 1, 2$ and $k = 3, 4, 5$ for $j= 0, 1, 2, ..., \infty$. This allows the small open economy assumption to be imposed in the short–run as well as in the long–run and provides six restrictions to identify A(0).

The second type of restrictions stems from the structural model and restrict the long–run level of the endogenous variables; these correspond to the zeros in the south–eastern quadrant of A(1).[10] These restrictions imply that particular structural innovation does not have a long–run effect on the level of the endogenous variable. For example, the structural model suggests that nominal shocks (the fifth structural innovation) do not have a long–run effect on the level of domestic output (the third variable). This restriction is summarized by the condition that $a(1)_{3,5} = \Sigma a_{3,5}(j)$ equals zero.[11] As discussed above, we also assume that fiscal shocks can have long–run effects on the real exchange rate but not on total GDP. In all, these conditions provide four additional restrictions to identify the A(0) matrix.

The third type of restrictions stems from the assumption that the structural innovations are mutually orthogonal. These conditions define the 15 additional restrictions needed to exactly identify the A(0) matrix. Although these three types of restrictions cannot be tested

[10]This second type of restrictions also include the zero in the north–western quadrant of matrix A(1), that is used to distinguish world interest rate shocks from terms of trade shocks.

[11]For a detailed discussion of these restrictions see Blanchard and Quah (1988). A discussion for a similar small open economy model is also found in Hoffmaister and Roldós (1996).

and are assumed to be valid, some corroboration of their usefulness in identifying the structural innovations is discussed below.

As noted before, the general equilibrium considerations of the small open economy model suggest that structural innovations will have joint dual effects on both the real exchange rate and the trade balance. This complicates the identification of structural innovations in a model that contains both of these variables. Hence, to simplify the identification this study presents the empirical evidence for two variants of the SVAR model summarized by equation (11). These models are based on the small open economy discussed above and share the block common exogenous external equations, but the equations defining the domestic part of the model differ. The domestic variables in Model 1 are those contained in equation (11), namely output, the real exchange rate, and prices, while in Model 2 the real exchange rate is replaced with the trade balance.

Estimating two variants of the SVAR model provides a simple way to check the appropriateness of the identification assumptions. By allowing a direct comparison of the effect of the structural innovations from two sets of estimates, the SVAR models provides suggestive evidence of robustness of the identification procedure and of the qualitative results. Also, estimating two models as opposed to adding a sixth equation to the model has the added benefit of conserving degrees of freedom.

III. Measuring Macroeconomic Fluctuations in Asia and Latin America

To measure the sources of macroeconomic fluctuations in the economies of Asia and in Latin American this study uses the SVAR model discussed above and applies it to pooled time series data, i.e. panel data. Before presenting the main empirical evidence on the sources of macroeconomic fluctuations for Asia and Latin America, this section briefly discusses the data used and the specific problems associated with the estimation of VAR models using panel data.

A. Data Sources

The data consists of two balanced panels of annual observations from 1970 through 1993; these panels consist of 15 Asian and 17 Latin American economies (see the country lists in Table A1). Most data series were taken from the International Financial Statistics (IFS): (i) output was measured as GDP at 1990 prices (line 99 b.p); (ii) the real exchange rate was calculated as the relative price of nontraded goods in terms of traded goods, proxied by the ratio of the CPI (line 64) divided by the product of the nominal exchange rate (line ae) and the PPI (line 63) of the United States; (iii) domestic price level was measured by the CPI; and (iv) the real world interest rate was measured as the Libor rate on a six month U.S. dollar deposits (line 601de) deflated by the PPI of the United States. The rest of the data series were taken from the World Economic Outlook (WEO) database: (i) terms of trade (TT); and

(ii) the trade balance proxied by the ratio of absorption (NTDD) to GDP (NGDP). For a few countries where the IFS data was incomplete, WEO data was used instead.

B. Estimation Issues

VAR models estimated using panel data are subject to the well known problems associated with estimating dynamic models with panel data (see Holtz–Eakin, Newey and Rosen (1988) and Nickell (1981)). The main problem is that the least square dummy variable (LSDV) estimator does not provide a consistent estimate as the number of individuals/ countries increases for a given number of observations per individual. Thus, for a typical panel data set that contains a large number of individuals with relatively few observations per individual, the LSDV estimator is usually inappropriate.

The LSDV estimator, however, is consistent as the number of observations per individual increases for a given number of individuals and is asymptotically equivalent to the maximum likelihood estimator (see Amemiya (1967)). Thus, the empirical evidence discussed below is based on LSDV estimates because the panel data used in this paper contains a relatively small number of individual/countries (about 15) compared to the number of observations for each country (24 annual observations) so that it is likely that the Nickell–bias is not very large (see Quah and Rauch (1990)). Moreover, recent Monte Carlo simulations suggest that when the number of individuals is small compared to the number of observations per individual, the LSDV estimator while only consistent as the number of individual grows, performs well in terms of its bias and is not very different from the Chamberlain (1983) Minimum Distance estimator (see Islam (1992)).

C. Macroeconomic Fluctuations in Asia

This section presents the main empirical evidence on macroeconomic variables (output, real exchange rate and the trade balance, and prices) for Asia, by discussing the relative importance of external (world interest rate, terms of trade) and domestic (supply, fiscal, and nominal) shocks—summarized by the variance decompositions—as well as the dynamics of adjustment—illustrated by the impulse response functions. This study refers to the typical economy as described by the pooled time series data. Despite the diversity that exists in the countries pooled in the two panel data sets, these data do not reject the validity of pooling the individual country time series.[12]

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[12]See Appendix III for the specifics of the estimated VAR models.

Output

Output growth fluctuations in the typical Asian economy are explained almost entirely by domestic shocks, with external shocks explaining a small fraction (roughly 10 percent) of these fluctuations (see Table 2). Amongst domestic shocks, supply shocks are the main source of output growth fluctuations, explaining roughly 90 percent of the total in the short– and long–run. Domestic demand shocks do not appear to play any role as a source of output fluctuations. Terms of trade and world interest rate shocks, each explain about 5 percent of output fluctuations in the long–run, but only terms of trade shocks are important in the short–run. Moreover, of the two external shocks, only terms of trade shocks are measured with precision, suggesting a minor role for world interest rate shocks.

The dynamics of adjustment of output in a typical Asian economy have the expected sign and confirm the relative importance of the different shocks (see Figure 1). Focusing our discussion on the adjustment of output to the two main sources of output movements in Asia (supply and terms of trade shocks) it is clear that these shocks lead to adjustments of differing magnitudes and speeds. In the long–run, a favorable supply shock leads to a larger long–run output expansion, about 2 1/2 percentage points above the baseline, compared with an expansion of about 1/2 percentage point above the baseline for a favorable terms of trade shock.[13] However, supply shocks lead to a slower output adjustment, with 75 percent of the adjustment completed in the first three years, compared with the output adjustment to terms of trade shocks, with 75 percent of the adjustment in the first year. This pattern of adjustment fits well with the usual interpretation of supply shocks: structural reforms and/or the adoption of new technology requires time to be fully absorbed by the economy.

Real exchange rate and the trade balance

Real exchange rate fluctuations in the typical Asian economy are also mostly due to domestic shocks, with external shocks explaining only a small fraction of its fluctuations (see Table 2, Model 1). Amongst the domestic shocks, fiscal shocks are the main source of fluctuation explaining slightly more than 85 percent of all fluctuations in the short–run and somewhat less in the long–run. Other domestic shocks—supply and nominal—explain a small, and imprecisely measured, share of real exchange rate fluctuations. External shocks play a small but significant role in real exchange rate fluctuations, as they explain roughly 10 percent of these fluctuations.[14]

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[13]The impulse responses are the responses to a one standard deviation shock. These impulse responses were then scaled so the shock equals one.

[14]Section IV provides additional evidence on the small role played by nominal shocks; this evidence corroborates the importance of fiscal shocks in explaining real exchange rate movements.

Table 2. Asia: Variance Decomposition of Domestic Variables 1/

(Standard errors in parenthesis)

	Model 1										Model 2									
	External				Domestic						External				Domestic					
	ϵ^{i*}		ϵ^{tt}		ϵ^{s}		ϵ^{f}		ϵ^{n}		ϵ^{i*}		ϵ^{tt}		ϵ^{s}		ϵ^{f}		ϵ^{n}	
Years	Percentage of the variance of domestic output due to:																			
1	0.0	(7.7)	5.6	(2.5)	93.7	(8.4)	0.4	(2.2)	0.2	(2.3)	0.0	(7.8)	5.6	(2.4)	92.9	(8.2)	0.8	(1.0)	0.6	(2.6)
2	4.9	(7.3)	5.9	(2.5)	88.6	(8.0)	0.4	(2.2)	0.2	(2.2)	4.4	(7.3)	6.4	(2.5)	87.9	(7.8)	0.8	(1.1)	0.5	(2.5)
3	6.2	(7.2)	5.6	(2.5)	87.7	(8.2)	0.4	(2.7)	0.2	(2.7)	5.5	(7.2)	6.0	(2.5)	87.3	(7.9)	0.7	(1.3)	0.4	(3.2)
4	6.0	(7.2)	5.4	(2.5)	88.0	(8.2)	0.3	(2.9)	0.2	(2.9)	5.4	(7.2)	5.9	(2.5)	87.6	(7.9)	0.6	(1.3)	0.4	(3.4)
5	5.9	(7.1)	5.4	(2.5)	88.2	(8.2)	0.4	(2.9)	0.2	(2.9)	5.3	(7.2)	5.8	(2.5)	87.7	(7.9)	0.6	(1.3)	0.4	(3.4)
10	5.9	(7.1)	5.4	(2.5)	88.1	(8.2)	0.3	(2.9)	0.2	(2.9)	5.3	(7.2)	5.8	(2.5)	87.7	(7.9)	0.6	(1.3)	0.5	(3.5)
	Percentage of the variance of the real exchange rate due to:										Percentage of the variance of the trade balance due to:									
1	0.0	(1.6)	6.5	(4.2)	0.0	(3.6)	90.9	(5.7)	2.5	(2.3)	0.0	(1.8)	11.7	(7.0)	7.5	(2.2)	80.7	(7.4)	0.0	(0.8)
2	1.6	(1.7)	5.9	(3.8)	0.2	(3.6)	88.4	(5.5)	3.8	(2.5)	10.6	(4.2)	11.5	(6.4)	7.3	(2.3)	70.5	(7.0)	0.0	(0.9)
3	4.4	(2.6)	5.8	(3.6)	0.3	(3.4)	85.6	(6.0)	4.0	(3.0)	10.6	(4.3)	12.3	(6.3)	7.3	(2.4)	69.6	(7.0)	0.0	(1.1)
4	4.7	(2.9)	5.7	(3.5)	0.3	(3.4)	84.5	(6.5)	4.7	(3.6)	13.0	(4.7)	12.0	(6.3)	7.1	(2.3)	67.7	(7.0)	0.0	(1.1)
5	4.8	(2.9)	5.7	(3.5)	0.3	(3.4)	84.1	(6.5)	5.1	(3.6)	13.4	(4.8)	12.0	(6.2)	7.1	(2.3)	67.4	(7.0)	0.0	(1.1)
10	4.9	(2.9)	5.7	(3.5)	0.3	(3.3)	83.9	(6.5)	5.2	(3.6)	13.8	(4.9)	12.0	(6.2)	7.1	(2.3)	67.0	(7.0)	0.0	(1.1)
	Percentage of the variance of domestic price inflation due to:																			
1	0.0	(6.6)	0.2	(2.8)	0.8	(5.6)	36.3	(9.7)	62.6	(8.8)	0.0	(7.8)	0.8	(4.1)	0.4	(4.3)	1.2	(2.2)	97.6	(8.1)
2	2.3	(7.5)	0.3	(2.4)	0.6	(5.0)	30.1	(9.0)	66.7	(8.4)	3.5	(8.3)	1.0	(3.5)	0.3	(3.8)	2.2	(2.3)	93.1	(7.9)
3	2.3	(7.6)	0.3	(2.3)	0.6	(5.0)	28.7	(8.9)	68.0	(8.3)	3.4	(8.4)	0.8	(3.4)	0.7	(3.9)	3.3	(2.5)	91.7	(7.9)
4	2.5	(7.5)	0.4	(2.3)	0.8	(5.0)	28.3	(8.8)	67.9	(8.2)	3.7	(8.3)	0.8	(3.4)	1.1	(3.9)	3.5	(2.5)	91.0	(7.9)
5	2.6	(7.5)	0.5	(2.3)	1.0	(5.0)	28.2	(8.8)	67.7	(8.2)	3.9	(8.3)	0.8	(3.4)	1.4	(3.8)	3.5	(2.5)	90.4	(7.8)
10	2.7	(7.5)	0.5	(2.3)	1.2	(5.0)	28.1	(8.8)	67.4	(8.2)	3.9	(8.3)	0.9	(3.4)	1.7	(3.8)	3.5	(2.4)	90.0	(7.8)

1/ Based on the estimated near VAR model with two lags, summarized in Table A2. The innovations ϵ^{i*}, ϵ^{tt}, ϵ^{s}, ϵ^{f}, and ϵ^{n} are respectively to world interest rate, terms of trade, domestic supply, fiscal and nominal policies. Approximate standard errors were computed by Monte Carlo Simulations, using 1000 replications. The standard errors provide a measure of the precision of the estimated variance decomposition; the ratio of the estimated variance decomposition to the standard errors are not distributed Student's t.

Trade balance movements in Asia are mostly due to domestic shocks (see Table 2, Model 2). Amongst the domestic shocks, fiscal shocks are the main source of fluctuations, explaining over 70 percent of the movements in the short–run, and somewhat less in the long–run. Other domestic shocks are much less important sources of fluctuation, with supply shocks having a small but precisely measured effect on the trade balance. However, in contrast with other macroeconomic variables in this study, external shocks tend play a role in explaining trade balance movements, especially in the medium– and long–run.

Both external shocks—world interest rate and terms of trade—are equally important sources of fluctuation of the trade balance, explaining between them about 25 percent of the total movements in the medium– and long–run. In the short–run, terms of trade shocks have a much larger impact than world interest rate shocks, suggesting the existence of non–trivial Harberger–Laursen–Metzler effects.

The dynamics of adjustment of the real exchange rate in a typical Asian economy have the expected sign and confirm the relative importance of supply shocks (see Figure 1). A fiscal shock leads to a large real appreciation of the exchange rate the extent of which occurs almost fully on impact, with a small overshooting in the first year. A world interest rate shock leads to a real depreciation, that occurs gradually over a three year period.

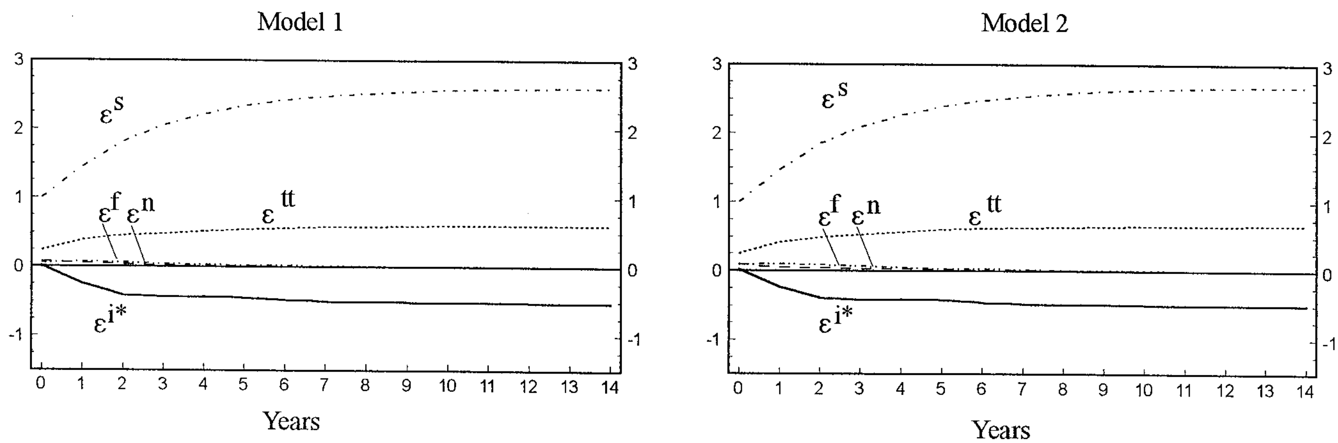
The dynamics of adjustment of the trade balance in a typical Asian economy are broadly consistent with the predictions of the intertemporal approach to the current account (see Obstfeld and Rogoff (1996) and Razin (1995)). A fiscal shock worsens the trade balance while a positive supply shock improves the trade balance especially in the short–run. A favorable terms of trade shock leads to an improvement of the trade balance that declines over time and is consistent with the real exchange rate appreciation that follows. However, while a world interest rate shock leads to a real exchange rate depreciation as predicted by the model, it does have the counterintuitive effect of worsening the trade balance particularly in the first few years.

Fiscal shocks, which are an important determinant of both the real exchange rate and the trade balance, lead to highly persistent real appreciation and to trade deficits. Although both results are consistent with the long–run model in Section II, the intertemporal budget constraint would require a nonmonotonic behavior of the trade balance. The persistence of the trade deficit suggest that either the sample period is not informative enough (indeed, the persistence of current account deficits for some of the countries of our sample is documented

Figure 1. Asia: Impulse Responses of Domestic Variables[1]

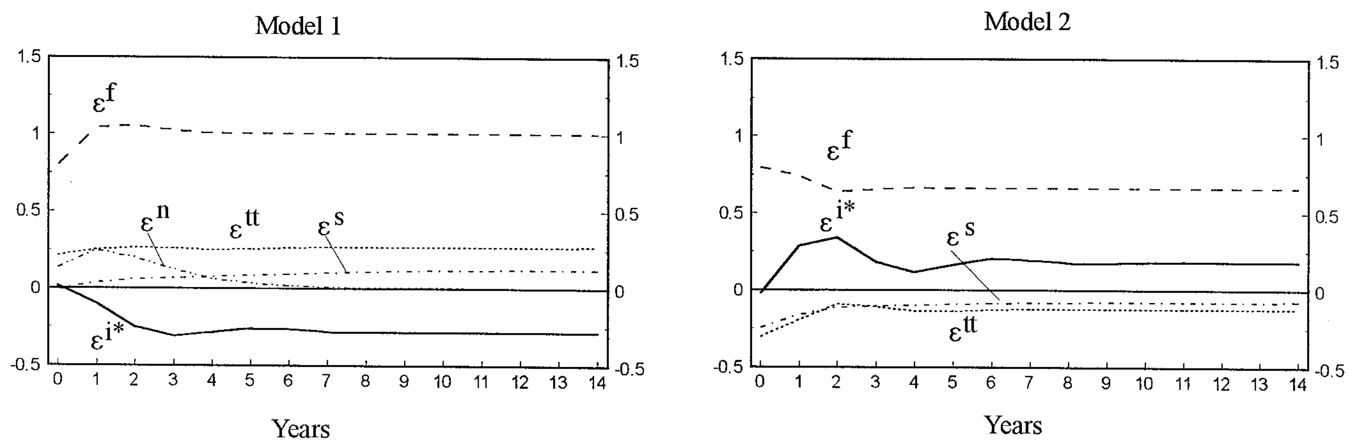
(Percent Deviations from Baseline)

Output

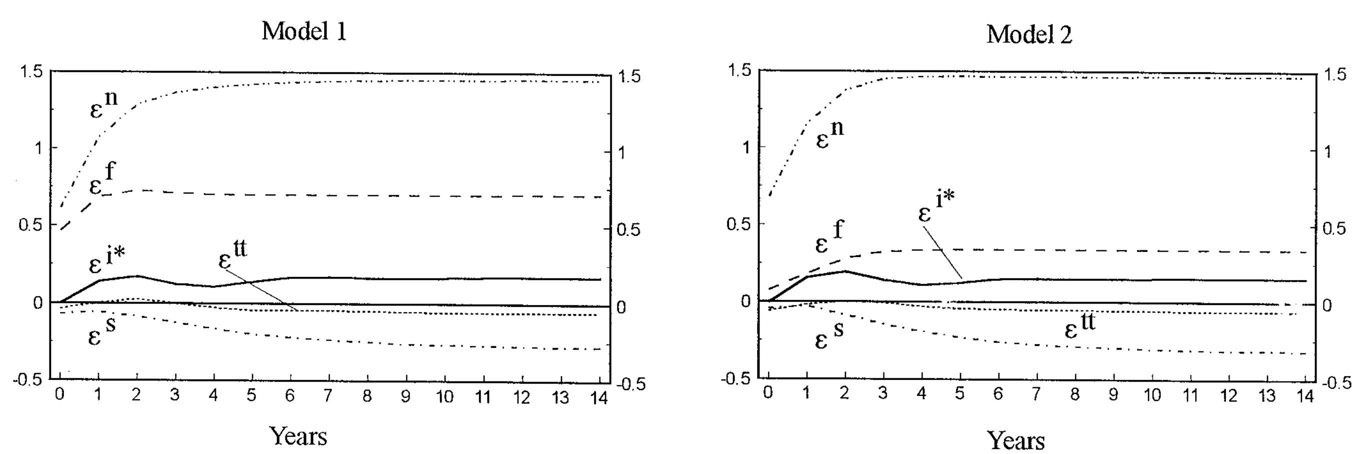


Real Exchange Rate

Trade Balance



Prices



[1] The innovations ε^{i*}, ε^{tt}, ε^{s}, ε^{f}, and ε^{n} are respectively to world interest rates, terms of trade, domestic supply, fiscal and nominal policies. The shocks usd to calculate these responses have been normalized to equal one.

in Milesi–Ferretti and Razin (1996)) and/or the relatively loose structure imposed on the data may not be sufficient to recover these effects.[15]

Inflation

Inflation movements in the typical Asian economy are explained almost entirely by domestic shocks (see Table 2). The empirical evidence suggests that domestic demand shocks—fiscal and nominal—are the main source of fluctuation of the rate of inflation, explaining about 95 percent of the movements in the short– and long–run. The evidence is less clear, however, regarding the decomposition of fiscal and nominal shocks. In Model 1 the results suggest that nominal shocks explain around 65 percent of the fluctuation of inflation, while fiscal shocks explain about 30. In Model 2, however, nominal shocks explain 90 percent of the movements in the rate of inflation (see Table 2, Model 1). This is intriguing because the importance of fiscal and nominal shocks does not change much—even quantitatively—in the variance decomposition of output fluctuations.

In any event, the dynamics of adjustment of prices in a typical Asian economy have the expected sign and are consistent with the relative importance of the different shocks (see Figure 1). Domestic demand shocks—fiscal and nominal—lead to price increases, while other shocks have a small impact on prices. Nominal shocks are absorbed fairly quickly into the price level, while the deflationary impact of supply shocks is assimilated much more gradually.

D. Macroeconomic Fluctuations in Latin America

This section presents the empirical results for the key macroeconomic variables of the typical Latin American economy. The variance decompositions of the SVAR provide a natural framework to discuss the relative importance of the different shocks, and the impulse–response analysis illustrates the dynamics of adjustment.[16]

Output

Output growth in Latin American economies is explained largely by domestic shocks (see Table 3). Amongst them, supply shocks are the main driving force of fluctuations in GDP. This is true both in the short- and the long–run where 65 percent of the variance of GDP is due to these shocks. Demand shocks explain a bit more than 10 percent of output fluctuations, especially in the short–run, with fiscal shocks being relatively more important

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[15]Ahmed and Park (1994) constrain shocks to the trade balance to not effect the long–run net foreign asset position of the country. This restriction, however, would not be consistent with our model because most shocks affect both the capital stock and the level of net foreign assets.

[16]See Appendix III for the specifics of the estimated VAR models.

Table 3. Latin America: Variance Decomposition of Domestic Variables 1/

(Standard errors in parenthesis)

	Model 1										Model 2									
	External				Domestic						External				Domestic					
Years	ϵ^{i*}		ϵ^{tt}		ϵ^{s}		ϵ^{f}		ϵ^{n}		ϵ^{i*}		ϵ^{tt}		ϵ^{s}		ϵ^{f}		ϵ^{n}	
	Percentage of the variance of domestic output due to:																			
1	0.0	(7.0)	0.4	(2.6)	87.7	(7.8)	8.4	(3.1)	3.5	(0.9)	0.0	(6.9)	0.0	(2.1)	92.5	(7.2)	1.3	(0.9)	6.1	(1.8)
2	6.1	(5.7)	6.6	(4.9)	77.0	(7.3)	7.2	(2.6)	3.1	(0.8)	6.5	(5.5)	5.8	(4.6)	82.2	(6.9)	0.8	(0.7)	4.6	(1.4)
3	17.1	(5.0)	6.4	(5.1)	67.6	(7.1)	6.5	(2.9)	2.4	(0.8)	16.7	(5.0)	6.5	(5.2)	72.4	(6.9)	0.8	(0.8)	3.6	(1.3)
4	20.0	(5.0)	6.1	(5.0)	65.2	(7.2)	6.4	(3.0)	2.4	(0.9)	19.2	(5.0)	6.2	(5.2)	70.4	(7.0)	0.7	(0.8)	3.4	(1.4)
5	19.9	(5.0)	5.8	(4.9)	65.3	(7.2)	6.4	(3.0)	2.4	(0.9)	19.1	(5.0)	6.1	(5.1)	70.6	(7.0)	0.7	(0.8)	3.3	(1.5)
10	20.2	(5.1)	5.7	(5.1)	65.1	(7.2)	6.4	(3.0)	2.5	(1.0)	19.2	(5.0)	6.2	(5.2)	70.2	(7.0)	0.7	(0.8)	3.5	(1.5)
	Percentage of the variance of the real exchange rate due to:										Percentage of the variance of the trade balance due to:									
1	0.0	(1.6)	1.0	(3.2)	0.1	(4.8)	89.5	(6.8)	9.3	(3.9)	0.2	(2.6)	30.8	(8.0)	2.4	(5.6)	57.2	(8.5)	9.3	(4.8)
2	0.0	(1.8)	2.6	(3.4)	1.4	(4.6)	86.6	(6.8)	9.1	(3.8)	0.3	(2.4)	32.0	(7.8)	3.6	(5.1)	55.1	(8.2)	8.8	(4.9)
3	0.0	(1.8)	2.7	(3.4)	1.4	(4.6)	86.2	(7.0)	9.4	(4.2)	0.8	(2.8)	31.0	(7.7)	3.9	(5.2)	54.4	(8.3)	9.9	(5.6)
4	0.0	(1.9)	2.7	(3.4)	1.4	(4.6)	85.8	(7.2)	10.1	(4.5)	1.0	(2.8)	31.0	(7.7)	3.9	(5.2)	54.1	(8.3)	10.0	(5.6)
5	0.0	(1.8)	2.7	(3.4)	1.4	(4.6)	85.6	(7.2)	10.2	(4.6)	1.1	(2.9)	30.9	(7.7)	3.9	(8.2)	54.0	(8.2)	10.0	(5.6)
10	0.0	(1.9)	2.7	(3.4)	1.4	(4.6)	85.4	(7.3)	10.5	(4.6)	1.2	(2.9)	30.9	(7.7)	3.9	(5.1)	53.8	(8.2)	10.1	(5.6)
	Percentage of the variance of domestic price inflation due to:																			
1	0.0	(2.5)	0.0	(1.9)	7.0	(11.5)	6.0	(7.0)	86.9	(11.5)	0.0	(3.4)	0.6	(3.0)	9.1	(11.0)	0.2	(2.7)	90.0	(11.3)
2	1.2	(1.8)	0.6	(2.2)	5.4	(11.3)	11.5	(8.5)	81.2	(11.1)	2.2	(2.3)	0.3	(2.4)	8.5	(11.4)	1.1	(2.9)	87.8	(11.3)
3	1.1	(1.9)	0.9	(2.9)	5.2	(11.4)	11.3	(8.6)	81.4	(11.0)	2.0	(2.4)	0.2	(2.3)	8.3	(11.6)	1.1	(2.8)	88.2	(11.4)
4	1.1	(2.0)	0.9	(3.0)	5.0	(11.4)	11.0	(8.5)	81.9	(10.9)	1.9	(2.5)	0.2	(2.5)	8.0	(11.6)	1.0	(2.8)	88.7	(11.3)
5	1.2	(2.0)	0.9	(3.1)	4.8	(11.4)	11.0	(8.4)	82.1	(10.8)	1.9	(1.5)	0.2	(2.5)	7.8	(11.5)	1.0	(2.8)	89.0	(11.3)
10	1.2	(2.0)	0.9	(3.1)	4.6	(11.4)	10.9	(8.4)	82.4	(10.8)	1.7	(2.5)	0.2	(2.6)	7.5	(11.5)	1.0	(2.8)	89.4	(11.3)

1/ Based on the estimated near VAR model with two lags, summarized in Table A3. The innovations ϵ^{i*}, ϵ^{tt}, ϵ^{s}, ϵ^{f}, and ϵ^{n} are respectively to world interest rate, terms of trade, domestic supply, fiscal and nominal policies. Approximate standard errors were computed by Monte Carlo Simulations, using 1000 replications. The standard errors provide a measure of the precision of the estimated variance decomposition; the ratio of the estimated variance decomposition to the standard errors are not distributed Student's t.

than nominal shocks. It is important to note the precision with which these results are measured, probably a reflection of the increased efficiency in extracting information associated with the use of panel data. It is interesting to note that, among the two external shocks, world interest rate shocks play a significantly larger role in output growth movements than terms of trade shocks. Moreover, this significant differential effect is robust to the alternative identification provided by Model 2.

The dynamic responses of output have the expected sign (see Figure 2), and as suggested by the variance decomposition, supply shocks have the largest effect on output and are large even on impact. Next in importance are world interest rate shocks which have virtually no effect on impact but become increasingly contractionary over the medium term.

Quite coincidentally, while the adjustment of output to both of these shocks cannot be characterized as slow, they both take about three years for roughly 75 percent of the adjustment to occur. Terms of trade shocks on the other hand lead to a quicker response of output—with nearly all of the adjustment within two years—that is positive but relatively small. A fiscal shock is slightly expansionary in the short–run, and the negative response of output to nominal shocks is consistent with the well documented contractionary effects of devaluations (see Lizondo and Montiel (1989)).

Real exchange rate and the trade balance

Real exchange rate movements in Latin America are mostly determined by domestic shocks. Fiscal shocks, in particular, account for more than 80 percent of the variance of the real exchange over the sample period (see Table 3, Model 1). The importance of these shocks, and the simulated precision, suggests that changes in fiscal policy stance are by far the most important determinant of the real exchange rate. Nominal shocks are a distant second most important factor explaining roughly 10 percent of real exchange rate fluctuations.[17]

[17]Section IV provides additional evidence on the role played by nominal shocks; this evidence corroborates the importance of fiscal shocks in explaining real exchange rate movements.

Somewhat surprisingly, neither external nor supply shocks appear to be significant determinants of real exchange rate movements.[18]

Trade balance fluctuations in Latin America are also determined mostly by domestic shocks (see Table 3, Model 2). Domestic shocks account for about 65 percent of the variance of the trade balance, with fiscal shocks explaining the bulk of the movements of the trade balance and nominal shocks accounting for roughly 10 percent. In contrast with the minor role they play vis–a–vis other macroeconomic variables in this study, external shocks explain a larger share of the movements of the trade balance. In particular, about 30 percent of that variance can be attributed to terms of trade shocks, reflecting the importance of the Harberger–Laursen–Metzler effect for the countries in this region.

In terms of dynamic responses, fiscal shocks lead to a large initial real exchange rate appreciation and a worsening of the external balance (see Figure 2). The appreciation is much more persistent than the trade deficit but, although about a third of the initial expansion in domestic absorption is reversed in two years, a full cycle in the trade balance is not observed.

External shocks lead to interesting dynamic responses of the real exchange rate and the trade account. A favorable terms of trade shock improves the trade account on impact, half of which is reversed by the second year. The accompanying real exchange rate appreciation occurs somewhat more gradually and is more persistent. A world interest rate shock leads to a gradual contraction in domestic absorption, that by the third year appears to accommodate the increased interest rate payments. Somewhat surprisingly, the real exchange rate does not respond to world interest rate shocks. This might be due to the fact that several countries in the region postponed nominal exchange rate adjustments following the record high world interest rates in the early 1980s, as they were using the nominal exchange rate as a disinflation instrument. Interestingly, the evidence regarding nominal shocks in Latin America suggest that these shocks are mostly capturing nominal exchange rate shocks. Indeed, nominal shocks lead to a real exchange rate depreciation, and a trade balance improvement.

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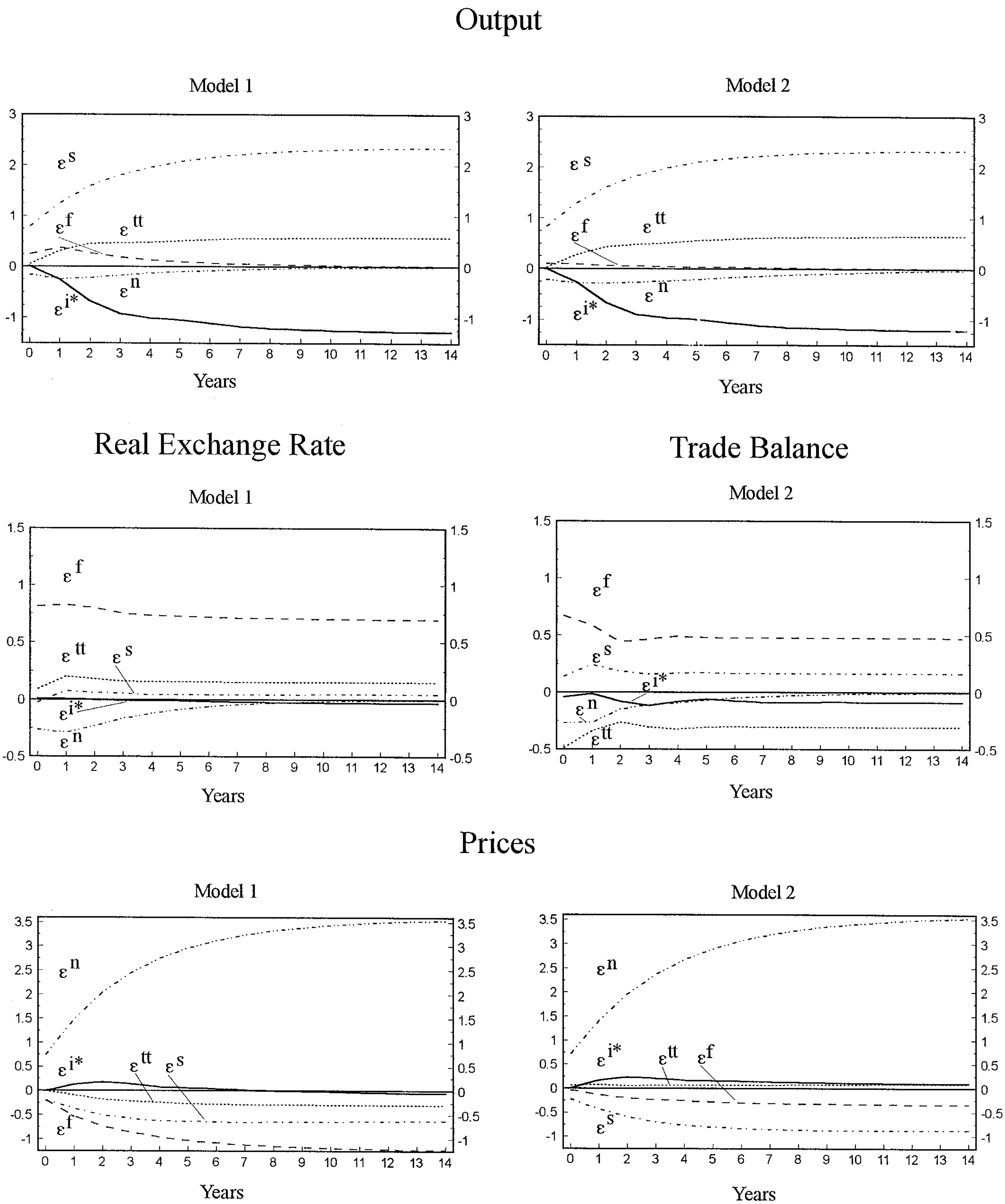
[18]Hausman and Gavin (1995) also find a small correlation between external shocks and real exchange rate volatility for Latin America. In contrast, Calvo, Leiderman and Reinhart (1993) find a large impact of external factors on the real exchange rate. It is possible, however, that this contrasting evidence is due to: (i) the sample period used (1988-91) that limits the evidence to the capital inflow episode, and (ii) domestic policy and supply shocks are not explicitly accounted for, and (iii) world output shocks (proxied by output shocks in the United States) are controled for instead of terms of trade shocks in this study.

Figure 2. Latin America: Impulse Responses of Domestic Variables [1]

(Percent Deviations from Baseline)



[1] The innovations ε^{i*}, ε^{tt}, ε^{s}, ε^{f} and ε^{n} are respectively to world interest rate, terms of trade, domestic supply, fiscal and nominal policies. The shocks usd to calculate these responses have been normalized to equal one.

Inflation

Movements in the rate of inflation for the typical Latin American economy during the sample period were mostly due to domestic factors. As expected in a region with high and volatile inflation, nominal shocks account for more than 80 percent of the variance of the price level (see Table 3). These shocks lead to sharp price increases on impact and thereafter lead to a prolonged period of price increases (see Figure 3). Other shocks are unimportant and measured imprecisely.

IV. Additional Evidence on Nominal Shocks

This study follows the standard practice in SVAR analysis of introducing nominal shocks in a fairly loose manner. With the notable exception of Gali (1992), this practice is common and allows the analysis to account for the effects of nominal shocks without having to formally model them. This strategy has been a useful way to capture the effects of nominal shocks, thus it was used here. However, the small role for nominal shocks in explaining output and real exchange rates fluctuations discussed above, warrants further analysis on the robustness of these results to alternative identification of nominal shocks. This section provides further evidence on the role of nominal shocks.

Nominal shocks have been identified as those shocks that do not have long–run effects on output or the real exchange rate, but may have a long–run effect on the nominal variable, namely the price level. Arguably, other nominal variables, such as the nominal exchange rate or money (M1), could have been used in the SVAR analysis. In this case nominal shocks would be identified as those shocks that do not have long–run effects on output or the real exchange rate, but may have a long–run effect on the alternative nominal variable. To the extent that the nominal exchange rate and money contain information on nominal shocks, replacing the price level with either one of them could provide useful additional information on nominal shocks. The results of replacing prices with the nominal exchange rate and with money are discussed below.

A. Nominal Shocks in Asia

To explore the effects of nominal shocks in Asia the SVAR models described in Section III were re–estimated replacing the price level first with the nominal exchange rate and then with M1. These re–estimated models were used to identify the structural shocks and to re–calculate the variance decomposition of domestic variables. To focus our discussion we have chosen to discuss the new variance decompositions for Model 1 (output, the real exchange rate, and the nominal variable). The variance decompositions from Model 2 (output, the trade balance, and the nominal variable) mostly corroborate the results discussed in Section III and for brevity are not reported here.[19]

The variance decomposition when either the nominal exchange rate or money (M1) is used as the nominal variable are very similar to those with the price level and corroborate most of the results for Asia (see Table 4): (i) output fluctuations are mostly driven by domestic shocks (supply shocks), and (ii) real exchange rates movements are mostly due to fiscal shocks. It is important to note that even when the nominal exchange rate or money is explicitly included in the SVAR model, the importance of nominal shocks as determinants of output and real exchange rate movements is quite small.

Regarding the evidence for the new nominal variables, fiscal shocks are the most important determinant of the nominal exchange rate, with smaller but important secondary roles for supply and terms of trade shocks. This contrasts with the evidence for money where nominal shocks are the most important determinant (as was the case for the price level) with supply and terms of trade playing secondary roles. It is worth noting that, while supply shocks are an important determinant of the variance of both the nominal exchange rate and money growth, this is not true for inflation. This is consistent with the identification of supply shocks: accelerations in output growth lead to higher money demand and/or nominal exchange rate appreciation, with little impact on inflation. If the acceleration of output growth was due to demand shocks, one would also expect an acceleration of inflation.[20]

B. Nominal Shocks in Latin America

The variance decomposition when either the nominal exchange rate or money (M1) is used as the nominal variable are very similar to those with the price level and corroborate most of the results discussed for Latin America (see Table 5): (i) output fluctuations are mostly driven by domestic shocks (supply shocks), and (ii) real exchange rates movements are mostly due to fiscal shocks. The small role played by nominal shocks in real exchange rate determination is confirmed: when the nominal exchange rate is included in the SVAR the variance of real exchange rate fluctuatins explained by nominal shocks (2.5 percent) is even

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[19]Where appropriate, we discuss the relevant evidence from Model 2.

[20]The variance decompositions for Model 2 (not reported) are consistent with these results: (i) output growth is mostly associated with domestic factors (supply), (ii) fiscal shocks (and to a lesser extent supply and terms of trade shocks) are the most important factor explaining nominal exchange rate movements, (iii) nominal shocks (and to a lesser degree supply and terms of trade) are the most important factor explaining money. Regarding the trade balance the variance decompositions corroborate the results presented in Section III: (i) domestic shocks, especially fiscal shocks, dominant its movements, with external shocks explaining about 25 percent of its movements.

Table 4. Asia: Robustness of the Variance Decomposition of Domestic Variables 1/

(Standard errors in parenthesis)

	Model 1 (Nominal Exchange Rate)					Model 1 (Money)				
	External		Domestic			External		Domestic		
	ϵ^{i*}	ϵ^{tt}	ϵ^{s}	ϵ^{f}	ϵ^{n}	ϵ^{i*}	ϵ^{tt}	ϵ^{s}	ϵ^{f}	ϵ^{n}
Years	Percentage of the variance of domestic output due to:									
1	0.0 (7.7)	5.6 (2.6)	90.9 (8.2)	1.3 (2.1)	2.0 (1.8)	0.0 (7.7)	5.9 (2.8)	89.9 (8.0)	0.4 (1.9)	3.7 (0.9)
2	5.5 (7.3)	6.4 (2.6)	85.3 (7.8)	1.2 (2.1)	1.6 (1.8)	4.0 (7.3)	6.9 (2.8)	85.3 (7.6)	0.3 (2.0)	3.4 (0.9)
3	7.5 (7.2)	6.1 (2.6)	83.9 (7.9)	1.1 (2.7)	1.4 (2.2)	5.5 (7.2)	6.7 (2.8)	84.5 (7.6)	0.3 (2.5)	3.1 (1.2)
4	7.4 (7.2)	6.0 (2.6)	84.2 (7.9)	1.0 (2.6)	1.4 (2.2)	5.3 (7.1)	6.5 (2.8)	84.9 (7.6)	0.3 (2.6)	3.0 (1.2)
5	7.2 (7.1)	6.0 (2.6)	84.3 (7.9)	1.0 (2.7)	1.4 (2.2)	5.2 (7.1)	6.5 (2.8)	85.0 (7.6)	0.3 (2.6)	2.9 (1.2)
10	7.3 (7.1)	6.1 (2.6)	84.0 (7.9)	1.1 (2.7)	1.4 (2.2)	5.2 (7.1)	6.5 (2.8)	85.1 (7.6)	0.3 (2.6)	2.9 (1.2)
	Percentage of the variance of the real exchange rate due to:									
1	0.0 (1.6)	5.9 (3.9)	2.7 (3.5)	91.2 (5.5)	0.1 (2.3)	0.0 (1.6)	5.5 (4.0)	0.0 (3.0)	94.4 (4.9)	0.0 (0.8)
2	0.3 (1.9)	5.7 (3.6)	2.9 (3.5)	90.2 (5.5)	0.8 (2.3)	0.1 (1.7)	5.5 (3.8)	0.5 (3.0)	93.4 (4.8)	0.4 (0.8)
3	4.7 (2.8)	5.7 (3.4)	2.9 (3.3)	85.9 (6.0)	0.8 (3.0)	3.3 (2.6)	5.4 (3.6)	0.5 (2.8)	90.3 (5.1)	0.5 (1.3)
4	5.3 (3.1)	5.6 (3.3)	2.9 (3.3)	85.1 (6.3)	0.8 (3.4)	3.9 (2.9)	5.4 (3.6)	0.5 (5.2)	89.6 (5.2)	0.5 (1.4)
5	5.4 (3.1)	5.6 (3.3)	3.0 (3.3)	85.0 (6.4)	0.9 (3.4)	3.9 (2.9)	5.4 (3.6)	0.5 (2.8)	89.5 (5.2)	0.5 (1.4)
10	5.6 (3.1)	5.6 (3.3)	3.1 (3.3)	84.8 (6.4)	1.0 (3.5)	4.1 (2.9)	5.4 (3.6)	0.5 (2.8)	89.4 (5.3)	0.5 (1.4)
	Percentage of the variance of nominal exchange rate due to:					Percentage of the variance of money due to:				
1	0.0 (6.5)	7.9 (3.0)	9.7 (7.0)	76.0 (9.5)	6.3 (8.3)	0.0 (7.0)	9.4 (3.1)	26.5 (6.9)	0.1 (9.0)	63.9 (6.4)
2	0.3 (7.5)	7.4 (2.6)	10.8 (6.0)	75.1 (8.9)	6.4 (7.8)	1.0 (8.0)	9.5 (2.8)	27.4 (5.9)	0.3 (8.5)	61.6 (6.0)
3	4.6 (7.6)	7.3 (2.6)	10.9 (6.0)	70.2 (8.7)	6.9 (7.7)	1.1 (8.0)	9.1 (2.8)	27.9 (5.8)	0.4 (8.3)	61.4 (5.8)
4	5.8 (7.5)	7.3 (2.5)	11.1 (6.0)	68.5 (8.7)	7.3 (7.7)	1.1 (8.0)	9.1 (2.7)	28.1 (5.8)	0.4 (8.3)	61.2 (5.8)
5	5.8 (7.6)	7.2 (2.5)	11.3 (5.9)	68.1 (8.7)	7.5 (7.6)	1.2 (8.0)	9.1 (2.7)	28.2 (5.8)	0.4 (8.3)	61.0 (5.7)
10	5.8 (7.6)	7.2 (2.5)	11.5 (5.9)	67.7 (8.7)	7.7 (7.6)	1.2 (8.0)	9.1 (2.7)	28.3 (5.8)	0.4 (8.3)	60.9 (5.7)

1/ Based on the estimated near VAR model with two lags analogous to the model in Table A2, but inflation has been replaced with either the nominal depreciation or money growth. The innovations ϵ^{i*}, ϵ^{tt}, ϵ^{s}, ϵ^{f}, and ϵ^{n} are respectively to world interest rate, terms of trade, domestic supply, fiscal and nominal policies. Approximate standard errors were computed by Monte Carlo Simulations, using 1000 replications. The standard errors provide a measure of the precision of the estimated variance decomposition; the ratio of the estimated variance decomposition to the standard errors are not distributed Student's t.

Table 5. Latin America: Robustness of the Variance Decomposition of Domestic Variables 1/

(Standard errors in parenthesis)

	Model 1 (Nominal Exchange Rate)										Model 1 (Money)									
	External				Domestic						External				Domestic					
	ϵ^{i*}		ϵ^{tt}		ϵ^{s}		ϵ^{f}		ϵ^{n}		ϵ^{i*}		ϵ^{tt}		ϵ^{s}		ϵ^{f}		ϵ^{n}	
Years	Percentage of the variance of domestic output due to:																			
1	0.0	(7.0)	0.3	(2.6)	91.5	(7.7)	7.9	(3.2)	0.1	(0.4)	0.0	(7.1)	0.3	(2.6)	90.5	(7.7)	6.6	(2.9)	2.6	(0.6)
2	6.5	(5.7)	6.3	(4.9)	78.9	(7.2)	7.8	(2.6)	0.4	(0.3)	6.2	(5.7)	6.8	(4.9)	79.3	(7.2)	5.8	(2.5)	1.7	(0.5)
3	17.3	(5.0)	6.2	(5.1)	69.2	(7.1)	6.9	(2.9)	0.3	(0.3)	16.9	(5.0)	6.6	(5.2)	69.4	(7.0)	5.6	(2.8)	1.4	(0.4)
4	20.3	(5.1)	5.7	(5.0)	66.8	(7.1)	6.8	(3.1)	0.3	(0.3)	20.0	(5.1)	6.1	(5.1)	66.9	(7.1)	5.5	(3.0)	1.4	(0.5)
5	20.3	(5.1)	5.6	(5.0)	66.9	(7.1)	6.9	(3.2)	0.3	(0.3)	20.0	(5.1)	6.0	(5.0)	66.9	(7.1)	5.5	(3.0)	1.4	(0.6)
10	20.4	(5.1)	5.6	(5.0)	66.7	(7.1)	6.9	(3.2)	0.3	(0.4)	20.2	(5.1)	6.0	(5.0)	66.8	(7.1)	5.5	(3.0)	1.4	(0.6)
	Percentage of the variance of the real exchange rate due to:																			
1	0.0	(1.6)	1.0	(3.3)	1.0	(4.7)	96.6	(5.9)	2.3	(1.5)	0.0	(1.6)	1.2	(3.3)	0.1	(4.9)	94.4	(6.2)	4.2	(2.0)
2	0.0	(1.8)	2.5	(3.5)	1.5	(4.5)	93.6	(6.0)	2.3	(1.4)	0.0	(1.8)	2.5	(3.5)	1.5	(4.8)	91.7	(6.3)	4.3	(2.0)
3	0.0	(1.8)	2.5	(3.5)	1.5	(4.5)	93.5	(6.0)	2.3	(1.6)	0.0	(1.8)	2.5	(3.5)	1.5	(4.7)	91.1	(6.4)	4.8	(2.3)
4	0.1	(1.9)	2.5	(3.5)	1.5	(4.5)	93.4	(6.1)	2.5	(1.7)	0.0	(1.9)	2.5	(3.5)	1.5	(4.7)	91.0	(6.4)	5.0	(2.5)
5	0.1	(1.8)	2.5	(3.5)	1.5	(4.5)	93.3	(6.1)	2.5	(1.8)	0.0	(1.9)	2.5	(3.5)	1.5	(4.8)	90.8	(6.5)	5.1	(2.5)
10	0.1	(1.9)	2.5	(3.5)	1.5	(4.5)	93.2	(6.1)	2.6	(1.8)	0.0	(2.0)	2.5	(3.5)	1.5	(4.8)	90.7	(6.5)	5.2	(2.5)
	Percentage of the variance of nominal exchange rate due to:										Percentage of the variance of money due to:									
1	0.0	(3.1)	0.0	(3.3)	0.7	(11.7)	81.5	(9.1)	17.7	(10.9)	0.1	(2.8)	13.6	(2.6)	0.9	(11.1)	0.0	(8.3)	85.3	(11.2)
2	0.3	(2.4)	0.3	(2.5)	2.2	(11.5)	76.4	(9.7)	20.8	(9.9)	0.4	(2.1)	10.3	(2.3)	1.1	(11.1)	0.9	(9.3)	87.3	(10.7)
3	0.7	(2.5)	0.3	(3.4)	2.4	(11.6)	74.6	(9.7)	21.9	(9.5)	0.4	(2.2)	8.6	(2.9)	1.1	(11.3)	2.2	(9.4)	87.7	(10.5)
4	1.0	(2.7)	0.3	(3.8)	2.6	(11.6)	73.5	(9.5)	22.5	(9.2)	0.4	(2.5)	8.0	(3.2)	1.2	(11.3)	2.3	(9.2)	88.0	(10.3)
5	1.1	(2.8)	0.3	(3.8)	2.8	(11.5)	73.0	(9.5)	22.8	(9.0)	0.5	(2.5)	7.7	(3.2)	1.3	(11.3)	2.4	(9.1)	88.1	(10.2)
10	1.2	(2.8)	0.3	(3.8)	3.0	(11.5)	72.3	(9.4)	23.1	(9.0)	0.5	(2.5)	7.3	(3.2)	1.5	(11.3)	2.4	(9.1)	88.2	(10.1)

1/ Based on the estimated near VAR model with two lags, analogy to the model summarized in Table A3 but inflation has been replaced with either the nominal depreciation or the money growth. The innovations ϵ^{i*}, ϵ^{tt}, ϵ^{s}, ϵ^{f}, and ϵ^{n} are respectively to world interest rate, terms of trade, domestic supply, fiscal and nominal policies. Approximate standard errors were computed by Monte Carlo Simulations, using 1000 replications. The standard errors provide a measure of the precision of the estimated variance decomposition; the ratio of the estimated variance decomposition to the standard errors are not distributed Student's t.

less than when innovations to the CPI or M1 are the sources of nominal impulses (explaining respectively 10 percent and 5 percent of the variance of the real exchange rate).

Regarding the evidence for the new nominal variables, fiscal shocks are the most important determinant of the nominal exchange rate (that contributes to the required changes ion the real exchange rate) with a secondary role for nominal shocks. This contrasts with the evidence for money where nominal shocks are the most important determinant with terms of trade playing a secondary role, especially in the short run (and presumably due to the monetization of foreign exchange reserves).[21]

V. Fiscal Shocks and Government Spending

This paper identifies fiscal shocks, ϵ^f, indirectly as shocks that do not have a long-run effect on the (log) level of output but are allowed to affect the long-run (log) level of the real exchange rate. Identifying ϵ^f in this manner is consistent with the model in Section II, and note that this empirical strategy does not rely on a direct measure of fiscal spending. Given the importance that these shocks play in explaining movements of the real exchange rate and the trade balance, it is important to verify that the SVAR identification has recovered shocks that are related to observed fiscal spending. This section provides evidence to that effect.[22]

Note that ϵ^f corresponds to the structural innovation of the change in fiscal spending (Δg), as is clear from the discussion in Section II-D. Using national accounts data to obtain a measure for Δg, we define it as the change in government consumption as a share of GDP

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[21]The variance decompositions for Model 2 (not reported) are consistent with these results: (i) output growth is mostly associated with domestic factors (supply), (ii) fiscal shocks are the most important factor explaining nominal exchange rate movements, (iii) nominal shocks (and to a lesser degree fiscal shocks) are the most important factor explaining money. Regarding the trade balance the variance decompositions corroborate the results presented in Section III with one exception. When money is included nominal shocks explain about a third of the movements of the trade balance, the other two thirds are explained roughly equally by fiscal and terms of trade shocks.

[22]Historical decompositions of the relevant time series have been used by Blanchard and Quah (1989) and Clarida and Gali (1995) to verify that the structural innovations recovered from the SVAR model are "reasonable." Using that approach in this panel data study would be extremely tedious because it would involve comparing the evidence for a total of 32 countries over a 20 year period. Moreover, judging these results would not be clear because the evidence in this paper should interpreted as for a typical developing country in Asia or in Latin America. To avoid the inherited arbitrariness of this exercise, we decided to follow a more direct route: checking the relation between the recovered structural fiscal structural shocks and actual changes in fiscal spending.

(change in IFS line 91f divided by line 99b). Using the available data for the countries in Asia and in Latin America included in this study, we proceed to check the relationship between ϵ^f and Δg.[23]

The most direct evidence of the relationship of fiscal shocks and actual fiscal spending can be obtained by estimating a model for Δg as a function exclusively of ϵ^f. A regression of this model yields the following results (t-statistics in parenthesis):[24]

Asia:	$\Delta g =$	$0.1864\ \epsilon^f$	$+ 0.0657$
		(2.9179)	(1.0216)
Latin America:	$\Delta g =$	$0.1515\ \epsilon^f$	-0.0147
		(2.6188)	(-0.2491)

It is clear from these results that there is a significant relation between the ϵ^f recovered from the SVAR models and the observed changes in fiscal spending.[25]

To test whether this statistically significant relationship is not simply reflecting mis-specified dynamics of Δg, we augmented these regression models with lagged Δg. This regression would verify whether ϵ^f remains significant when the dynamics of Δg are explicitly accounted for. To maintain consistency with the SVAR models estimated above, we present the results with two lags of Δg:

Asia:	$\Delta g =$	$0.1910\ \epsilon^f$	$+ 0.0052 \Delta g_{t-1}$	$- 0.1416\ \Delta g_{t-2}$	$+ 0.0707$
		(2.9670)	(0.0868)	(-2.3912)	(1.0936)
Latin America:	$\Delta g =$	$0.1542\ \epsilon^f$	$-0.0309\ \Delta g_{t-1}$	$- 0.0537\ \Delta g_{t-2}$	-0.0192
		(2.6483)	(-0.5385)	(-0.9726)	(-0.3248)

Note that the size and the statistical significance of the coefficient for ϵ^f is virtually unchanged. This provides further evidence that the recovered ϵ^f is indeed directly related to

[23]This data is not available for Bangladesh, China and Myanmar and were excluded from the panel of Asian countries in this section.

[24]Preliminary estimation of these models indicated the presence of country-specific heteroskedasticity, and thus were estimated with weighted least squares. No evidence for either fixed- or time-effects was found, conditional on country-specific heteroskedasticity.

[25]Not surprising, we note that running similar regressions with the recovered supply or nominal shocks does not uncover any statistically significant relationship.

fiscal spending even when government spending dynamics are accounted for.[26] These simple tests suggests that the SVAR analysis has recovered a "fiscal" shock that reflects fiscal spending shocks in the countries in our sample.

VI. Common Features and Final Remarks

The empirical evidence suggests some interesting in common features and differences of the business cycles in the developing countries in Asia and Latin America. This evidence is related to available evidence for the industrial countries.

Among the common features in these developing countries is the fact that supply shocks—productivity (structural reforms), and labor supply—play a substantial role in explaining output movements even in the short–run. This is consistent with the evidence for the U.S. economy (Blanchard and Quah (1989), Shapiro and Watson (1988) and Gali (1992)) as well as for the U.K., although the short–run contribution of aggregate demand is larger than that of aggregate supply for France and Germany (see Karras (1994)). This evidence coupled with the relatively large role of supply shocks found for developing countries in this study provides support to what McCallum (1989) calls "weak" version of equilibrium (real) business cycles models, i.e., models where aggregate supply shocks are more important than aggregate demand shocks for short–run fluctuations. The methodology used in this study, however, does not allow to discriminate across models in terms of their propagation mechanisms.

Both the real exchange rate and the trade balance in these developing countries are largely determined by fiscal shocks. This is consistent with the evidence for industrial countries, see Froot and Rogoff (1991) and Debelle and Faruqee (1996). The small role played by nominal factors in explaining real exchange rate fluctuations is consistent with some evidence for industrial countries, see Lastrapes (1992). Clarida and Gali (1995), however, find a much larger role for nominal shocks for the US$/DM and the US$/Yen exchange rates, but their results for the US$/£ and US$/Canadian Dollar appear to be consistent with the results in this paper. The available evidence suggests to us that nominal shocks are important determinants of the behavior of real exchange rates in large industrialized countries, but less so in small developing countries.[27]

It is worth noting that the importance of fiscal shocks in explaining the real exchange rate and the trade balance (and the small role of nominal shocks in explaining output and the real exchange rate) in Asia and in Latin America is robust to alternative specifications of the

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[26]Further tests with up to a maximum of four lag for Δg confirms these results.

[27]For a smaller sample of developing countries, Edwards (1989) also finds an insignificant role for monetary innovations.

nominal variable. The small role for nominal shocks in explaining movements of these variables cautions against relying on models that focus mostly on nominal variables as short–run determinants of the real exchange rate in developing countries.

This study also finds a relatively small role for external shocks in general, and for terms of trade shocks in particular, in explaining output fluctuations in developing countries. This contrasts with two recent studies. Based on a stylized developing country, Mendoza (1995) finds that external shocks, in particular terms of trade shocks, explain roughly 50 percent of the observed variability of GDP and real exchange rates. Using data for a group of Latin American countries, Hausman and Gavin (1995) find that the role for external shocks in GDP and real exchange rate fluctuations is in line with our results, but they find that terms of trade not world interest rates shocks, are the main external shocks.

Leaving aside methodological differences with this study (calibration versus estimation in the former study and single equation versus multiple equations in the latter study) the differences may be due to the richer specification of economic shocks considered and controlled for in this study. By not allowing for domestic demand shocks and more importantly world interest rate shocks, Mendoza's (1995) terms of trade results may be picking-up the effect of these shocks, especially the effect of world interest rates that have been found to be correlated with terms of trade by Borensztein and Reinhart (1994). This correlation is also likely to be behind the importance of terms of trade in Hausman and Gavin (1995), although it is possible that this effect is partially offset because they control for capital account shocks which may proxy for world interest rates especially in the 1990s.

Finally, it is also interesting to note that in both regions external shocks seem to have a relatively larger impact on the trade balance than on the real exchange rate. Although terms of trade shocks do not play a significant role in output fluctuations they do play a role in the movements of the trade balance. This Harberger–Laursen–Metzler effect appears to be relatively larger in Latin American countries. Devereux and Connolly (1996) also find a weak influence of the terms of trade on the real exchange rate for a small sample of developing countries, but Edwards (1989) and Roldós (1990) show that the opposite is true when terms of trade shocks are decomposed into temporary and permanent components.

Despite the similarities between business cycles of the developing countries in Asia and in Latin America, there are not identical.[28] The framework used this paper, however, does not allow us to discriminate between differences due to the intrinsic propagation mechanisms from differences due to the dynamic properties of the exogenous shocks. The fact remains that the dynamic behavior differs. A notable difference between Asia and Latin America is the impact of nominal shocks that lead to a real depreciation and a contraction of output in Latin America, with almost the exact opposite effect in Asia. In Latin America these results accord

[28]The null hypothesis that the VAR models for Asia and Latin America are the same is rejected by the data. See Appendix IV for details.

well with the evidence stemming from the literature on contractionary effects of devaluations, notably Edwards (1986) and Lizondo and Montiel (1991). In Asia these results seem to reflect the more conventional overheating pressures as discussed in Coe and McDermott (1996), although these effects appear to be small.

There are also differences in the sources of business cycles for these developing countries. First, developing countries in Asia appears to be more resilient to shocks emanating from the world economy. This is suggested from the small share of output fluctuations that are explained by external shocks, about 10 percent, compared with Latin America where they explain about 25 percent of output movements. A second difference, that is related to the first, is the share of output movements explained by world interest rate shocks, that accounts for about 20 percent in Latin America and only about 5 percent in Asia. Moreover, the long–run output response to a world interest rate hike is about twice as large in Latin America as it is in Asia. These results are consistent with the important role assigned to world interest rates shocks in these regions by Calvo, Leiderman and Reinhart (1994). That study, however, stresses the effects on real exchange rates and the capital account, while this study finds a larger impact on GDP fluctuations. And third, demand shocks do have some short–run role on output fluctuations in Latin America, while their impact is almost nil in Asia. This is consistent with the analysis of Sachs (1985) that attributes the differential macroeconomic performance to different policies pursued in response to the lost access to international capital markets of these countries following the external debt crisis of the 1980s, as well as with the emphasis of policy instability in Latin America stressed by Hausman and Gavin (1995).

Table 1 suggested that the contrasting macroeconomic performance of Asia compared to Latin America might be traced back to the higher volatility of external shocks and of domestic policies in the Latin America. This study suggests that the higher variability in the real exchange rate and the rate of inflation are associated with higher variability of fiscal and monetary policies. External volatility seems to play a secondary role in explaining the contrasting macroeconomic performance, when compared to domestic factors. This evidence also suggests a primary role for supply-side factors in explaining the cyclical behavior of output growth over the business cycle. In sum, this study suggests that the cyclical effects of structural reforms and technology adoption appear to be of primary importance for understanding business cycles in developing countries.

LONG–RUN EFFECTS OF FISCAL SHOCKS

The long–run equilibrium of the model is summarized by equations (7) and (8) in the text. Equation (7) can be re-written in log difference form assuming Cobb–Douglas preferences and using the implicit equilibrium real exchange rate from equation (4) as:

$$d\ \log\ (Y_x - r*D) \ = \ d\ \log\ (1 - g) + d\ \log\ (L - l_x K) \qquad \textbf{(A1)}$$

Defining the share of debt service relative to tradable income as:

$$s \ = \ \frac{r*D}{Y_x \ - \ r*D} \qquad \textbf{(A2)}$$

the left hand side of equation (A1) can then be rewritten as:

$$(1 + s)\ \mathrm{dlog}\, Y_x \ - \ s\ \mathrm{dlog}\, r*D \ = \ (1 + s)\ \mathrm{dlog}\, Bl_x^{\alpha} K \ - \ s\left(\frac{K}{D}\right) \mathrm{dlog} K \qquad \textbf{(A3)}$$

where the right hand side of equation (A3) uses the fact that K and D are perfect substitutes. Substituting equation (A3) in equation (A1), we obtain that:

$$\mathrm{dlog}\, K \ = \ -\left(\frac{g}{1 - g}\right)\left[(1 + s) + \left(\frac{L_x}{L_n}\right) - s\left(\frac{K}{D}\right)\right]\mathrm{dlog}\, g \qquad \textbf{(A4)}$$

For a large range of parameter values, equation (A4) implies that an increase in government spending leads to a decline in the capital stock. For example, the ratio of external debt service to total GDP to be roughly 3 percent as in Mendoza (1995) and assuming that tradable goods are roughly half of total GDP, s would then be equal to 6 percent. Assuming a world interest rate of 6 percent and a capital/output ratio of 3, then the ratio K/D would equal 3. In this case, for the term inside the square brackets in equation (A4) to be negative, the stock of external debt would have to be less than 3 percent of the capital stock; highly unlikely for the developing countries considered in this study.

The impact of a fiscal expansion--and the consequent decline in K--on GDP and on the real exchange rate are given by the respective coefficients on equations (5) and (9). In order to assess the relative impact on GDP and the real exchange rate we take estimates of the relevant parameters from three studies. Chenery, Robinson and Syrquin (1986) study a large sample of developing countries and estimate $\lambda_n = 0.42$, $s_n = 0.52$ and $\beta = 0.6$, and Mendoza (1995) estimates $\lambda_n = 0.60$, $s_n = 0.50$ and $\beta = 0.34$. These parameter values yield a response of the real exchange rate that is, respectively, 2.3 and 2.6 times that of GDP. Stockman and Tesar (1995) estimate $\lambda_n = 0.48$, $s_n = 0.50$ and $\beta = 0.56$ for a sample of industrialized countries, and these parameter values imply a response of the real exchange rate that is twelve times that of GDP.

BRIEF DESCRIPTION OF BLANCHARD–QUAH IDENTIFICATION

Consider the following restatement of the structural model in equation (11):

$$\Delta x = A(L)\epsilon, \qquad \textbf{(A5)}$$

where $A(L) = A_0 + A_1L + A_2L^2 + \ldots$ The reduced form or Wold representation of the model is given by:

$$\Delta x = C(L)\mu \qquad \textbf{(A6)}$$

where $C(L) = I + C_1L + C_2L^2 + \ldots$ where $E[\mu]=0$ and $E[\mu\mu']=\Omega$. Note that the sequence of C_i matrices can be obtained by inverting the standard VAR representation of Δx.

Comparing the structural model to the reduced form model, note that for j=0 (lags omitted for clarity) $A(0)\epsilon=\mu$ because $C(0)= I$. Lagging this expression j periods yields $A(j)\epsilon_{-j}=C(j)\mu_{-j}$, so that $A(j)=C(j)A(0)$. The structural model, thus, is obtained by post–multiplying the reduced form model C(L) by the A(0) matrix, i.e., the structural model is fully identified by A(0).

Note further when A(1) is lower triangular the calculation of A(0) is simplified.[29] Specifically, for j=1 the above derivation shows that $A(1)=C(1)A(0)$ and using the fact that $A(0)A(0)'=\Omega$:

$$A(1)A(1)' = C(1)\Omega C(1)', \qquad \textbf{(A7)}$$

so that A(1) can be obtained as the lower Choleski decomposition of the matrix $C(1)\Omega C(1)'$. A(0) is then obtained as $C(1)^{-1}A(1)$.

[29] To the best of our knowledge this simplification was first suggested by Lastrapes (1992) in a footnote to page 532.

VAR Model Preliminaries, Small Open Economy Assumption, and Robustness

The VAR models were estimated with two panel data sets consisting of 17 and 15 countries in Asia and Latin America respectively (see Table A1). The SVAR methodology used in this study implicitly assumes that: (i) the first differences of the series be I(0), and (ii) the levels of these series not cointegrate. No formal test for either assumption is attempted here due to preliminary state of the literature that deals with testing for unit roots in panel data (see Levin and Linn (1993) and Im, Pesaran, and Shin (1996)). It is very likely, however, that the first differences of the series included in our models (see equation (11) in the main body of the text) are stationary, i.e., the (log) levels of these series have at most one unit root. Regarding cointegration, to the best of our knowledge no test has yet been proposed in the literature. In principle a test could be based on the residual of a potential panel cointegrating regression. As is the case for single-country tests, this procedure would arbitrarily assume the number of cointegrating vectors and would rule out a zero coefficient on the dependent variable in the regression. More importantly, little is known about statistical properties of such a test. The lack of cointegration assumed in this study, however, is consistent with the limited amount of available evidence for individual developing countries (see Hoffmaister and Roldós (1996)).

The lag selection for VAR models with panel data is somewhat more difficult than for single country data (see Holtz-Eakin, Newey and Rosen (1988)). This study uses two lags in all of the models and checks for the robustness of our results to the number of lags used as discussed below. Initial testing for each panel VAR with two lags suggested that a common variance for the individual countries in the panel is rejected by the data (see Tables A2 and A3). Thus, further tests and estimates are based on weighted least squares (feasible GLS), i.e., these tests and estimates are conditional on country specific heteroskedasticity.

The deterministic part of the panel VAR model consists only of a common intercept in each equation because we find no evidence of country–specific intercepts and time–specific intercepts are not separately identifiable. Following fairly standard panel estimation techniques the null hypothesis of a common intercept could not be rejected in favor of country–specific intercepts (see Table A2 and Table A3); to conserve degrees of freedom no country specific intercepts were added to the model.[30] Regarding time–specific intercepts we note that these cannot be separately identified in our model because the *world* interest rate series is a "time–period specific" series, i.e., for each time–period it has a common value for all countries. Time–specific dummies would be perfectly collinear to the world interest rate series and thus would not be identifiable.

[30]There is some weak evidence in favor of fixed-effects in Asia. It is worth noting, however, that the qualitative results discussed above are robust to including country specific intercepts, and for consistency we chose to report the results without these effects.

Table A1. Country Lists

Asia	Latin America
Bangladesh	Argentina
China	Bolivia
Hong Kong	Brazil
India	Chile
Indonesia	Colombia
Korea	Costa Rica
Malaysia	Ecuador
Myanmar	El Salvador
Nepal	Guatemala
Pakistan	Honduras
Philippines	Mexico
Singapore	Nicaragua
Sri Lanka	Panama
Taiwan, Province of China	Paraguay
Thailand	Peru
	Uruguay
	Venezuela

Table A2. Asia: Summary of Estimation Results, Annual Observations from 1973-93 1/

	Model 1					Model 2				
	Δi*	Δtt	Δy	Δq	Δp	Δi*	Δtt	Δy	ΔA/Y	Δp
Test of Panel Homogeneity										
Common variance	...	134.28**	77.25**	85.45**	80.11**	...	134.28**	79.34**	101.40**	82.08**
Common intercept	...	0.81	2.43**	1.57	1.65*	...	0.81	2.40**	0.68	1.99**
Coefficient of determination (R^2)	0.19	0.28	0.43	0.29	0.65	0.19	0.28	0.44	0.25	0.63
Adjusted R^2 ($\bar{R}^2$)	0.17	0.22	0.37	0.22	0.61	0.17	0.22	0.38	0.18	0.60
Standard error of estimate	1.00	0.98	1.06	0.95	0.85	1.00	0.98	1.06	1.07	0.87
F-test for the significance of regressors:										
Δi*	27.87**	4.53*	0.65	0.21	0.52	27.87**	4.53*	0.74	1.88	0.28
Δtt	0.92	8.55**	0.22	0.83	0.28	0.92	8.55**	0.06	0.94	0.29
Δy	...	...	83.72**	0.83	0.31	...	...	84.63**	0.79	0.66
Δq/ΔA/Y	...	...	1.02	10.44	9.13**	...	...	1.22	2.86**	2.27
Δp	...	...	0.27	3.02*	129.51**	...	...	0.22	0.46	116.06**
F-test for common dynamics	...	0.73	1.13	0.77	1.05	...	0.73	1.24	0.87	0.87
Contemporaneous covariance correlations of the reduced form innovations										
Δi*	1.00	...	...	...	...	1.00	...	...	...	...
Δtt	--	0.88	...	...	...	--	0.88	...	...	...
Δy	--	0.12	1.01	...	...	--	-0.17	1.02	...	...
Δq/ΔA/Y	--	0.13	0.05	0.82	...	--	-0.14	-0.11	0.85	...
Δp	--	-0.06	-0.02	0.42	0.65	--	-0.03	--	0.05	0.68

Note: The near-VAR models include two lags and are estimated with country-specific variances (feasible GLS). The countries included in the estimation are detailed in Table A1. The common variance test checks for country-specific variances, i.e., individual-specific heteroskedasticity. This test and the common intercept test were performed in a preliminary regression that included a common intercept. The null hypothesis for the test of common dynamics states that all countries in the panel have a common slope coefficients versus the alternative of country-specific slope coefficients; this test is performed conditional on country-specific variances. Asterisks, * (**), denote statistical significance at 5 (1) percent significance level. The contemporaneous covariance matrix shows the variance of the near-VAR innovations along the main diagonal and the correlation coefficients off the main diagonal.

Table A3. Latin America: Summary of Estimation Results, Annual Observations from 1973-93 1/

	Model 1					Model 2				
	Δi*	Δtt	Δy	Δq	Δp	Δi*	Δtt	Δy	ΔA/Y	Δp
Test of Panel Homogeneity										
Common variance	...	68.54**	99.08**	149.70**	520.18**	...	68.54**	98.40**	99.10**	519.68**
Common intercept	...	0.26	0.58	0.82	1.42	...	0.26	0.68	2.08	1.34
Coefficient of determination (R^2)	0.19	0.22	0.58	0.16	0.74	0.19	0.22	0.56	0.32	0.74
Adjusted R^2 ($\bar{R}^2$)	0.18	0.15	0.54	0.06	0.71	0.18	0.15	0.51	0.24	0.71
Standard error of estimate	1.00	0.95	0.97	0.97	0.88	1.00	0.95	0.98	0.94	0.86
F-test for the significance of regressors:										
Δi*	28.57**	5.17*	0.87	0.17	0.29	28.57*	5.17*	0.45	4.33*	0.60
Δtt	1.40	1.97*	8.73**	2.50*	0.36	1.40	1.97	5.44**	1.29	0.47
Δy	...	...	63.63**	0.94	1.42	...	...	61.44**	1.56	1.14
Δq/ΔA/Y	...	...	8.18**	0.24	7.84**	...	...	1.28	10.47**	0.53
Δp	...	...	0.86	1.33	318.34**	...	...	0.78	1.39	336.58**
F-test for common dynamics	...	0.83	1.38*	0.80	1.13	...	0.81	1.12	0.74	0.67
Contemporaneous covariance/ correlations of the reduced form innovations										
Δi*	1.00	...	...	...	...	1.00	...	...	...	...
Δtt	--	0.82	...	...	...	--	0.82	...	...	...
Δy	--	0.03	0.84	...	...	--	0.01	0.85	...	...
Δq/ΔA/Y	--	0.05	0.16	0.84	...	--	-0.32	0.17	0.79	...
Δp	--	--	-0.25	-0.25	0.67	--	0.02	-0.27	-0.20	0.66

Note: The near-VAR models include two lags and are estimated with country-specific variances (feasible GLS). The countries included in the estimation are detailed in Table A1. Three countries, namely Brazil, Nicaragua, and Peru, were excluded from the estimation due to stability problems with the estimated inflation equation. The common variance test checks for country-specific variances, i.e., individual-specific heteroskedasticity. This test and the common intercept test were performed in a preliminary regression that included a common intercept. The null hypothesis for the test of common dynamics states that all countries in the panel have a common slope coefficients versus the alternative of country-specific slope coefficients; this test is performed conditional on country-specific variances. Asterisks, * (**), denote statistical significance at 5 (1) percent significance level. The contemporaneous covariance matrix shows the variance of the near-VAR innovations along the main diagonal and the correlation coefficients off the main diagonal.

The panel VAR models used in the main body of the text to identify the structural model imposes the small open economy (soe) assumption. As noted above, this assumption is imposed both in the short– and the long–run by using a near VAR model specification. This specification of model requires that the equations for the world interest rate and the terms of trade be block exogenous, i.e. these equations contain lags only of the world interest rate and the terms of trade.

To test the soe assumption we calculate an F–statistic and test for the significance of the coefficients of domestic variables (output, real exchange rate/ trade balance, and prices) in each of the block exogenous equations.[31] At conventional significance levels, the test statistics do not reject the null hypothesis for any of the block exogenous equations in Asia or in Latin America. This suggests that indeed domestic shocks for a typical economy in Asia or in Latin America do not affect the world interest rates or their terms of trade.[32]

To test the robustness of the results in this paper to changes in the number of lags included, we re–estimated the near VAR models for Asia and Latin America with one and four lags. The variance decomposition and the impulse responses from these models are qualitatively similar to those presented in the paper, and corroborate our main results. This suggests that the conclusions drawn in the main body of the text do not appear to be overly sensitive to the number of lags used to estimate the model. It should be noted, however, that the estimates with four lags are less precise than those with 1 or 2 lags and the impulse responses were more complex.

A final point regarding the OLS estimates used in this paper and efficient estimation of near VAR models. In principal, the OLS estimates used in this study are not efficient. This is because the estimates of the "endogenous" (domestic) equations do not reflect the block exogeneity of the world equations. In this study, however, this is not likely to be critical because of the small correlation of world shocks with domestic shocks. To corroborate the robustness of our results, we re–estimated the near VAR models used to calculate the main results of this study using Zellner (1962) seemingly unrelated regressions (SUR) technique; the variance decompositions and the impulse responses are qualitatively unchanged. Since

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[31]Doan (1992) suggests using a multivariate extension of Granger causality test based on χ^2 statistic to test for block exogeneity. However, this test cannot be applied in this context because the degrees of freedom for the two equations differs due to the fact that the world interest rate equation is a time–specific series.

[32]The F–statistics (with the degrees of freedom indicated in parenthesis) for the world interest rate and the terms of trade equations are respectively 0.14 (6,10), 0.79 (6,284) for Asia and 0.13 (6,10), 1.08 (6,263) for Latin America. Note that the degrees of freedom for the world interest rate tests reflect the fact that the series is time–specific, with 21 independent observations (1973–93).

these estimates corroborate the qualitative conclusions reached with OLS estimates we chose to report the results from the more commonly used OLS estimates.

Pooling the Country Data for Asia and Latin America

While the macroeconomic experience in Asia and Latin America appears to be quite different (see Table 1) this does not necessarily translate into statistically significant differences. If in fact the data from these regions did not reject the null hypothesis that these regions are the same, then pooling the data from both regions would increase the efficiency of the estimates.

To test the null hypothesis that the VAR model from Asia and Latin America are the same, we performed an F–test on the equations of the VAR model.[33] The test was performed by comparing the restricted residuals from a model that pooled both regions and constrained the coefficients to be the same across regions, to the unrestricted residuals from the estimates used in this study. Not surprisingly, at conventional levels of significance the F–tests reject the null of equality corroborating our prior that pooling the data for Asia with that of Latin America to study the sources of business fluctuations is not sensible.[34]

As a final test on pooling the data for the developing countries in Asian and in Latin America, we test whether the null hypothesis (for each region) that the coefficients for the individual country are the same, versus the alternative hypothesis that the coefficients are country specific. The null hypothesis was tested with an F–test using the restricted residuals from the near VAR models in this study compared to unrestricted residuals from regressions that estimated a VAR model for each individual country. At conventional levels of significance the F–tests did not reject the null hypothesis of equality for each region.[35] This suggest that pooling the data for the developing countries in Asia and in Latin America, provides valuable information on the intra–country variation for the developing countries in Asia and in Latin America.

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[33]This test was not performed on the world interest rate equation because by definition this equation is the same across regions since that series, as noted before, is time-period specific.

[34]The F–statistics (with the degrees of freedom indicated in parenthesis) for the terms of trade, output, real exchange rate, and price equation are respectively 1.91 (4,584), 4.38 (10,578), 2.64 (10, 578), and 2.73 (10, 578).

[35]The F–statistics (with the degrees of freedom indicated in parenthesis) for the terms of trade, output, real exchange rate, and price equation are respectively 0.76 (70, 210), 0.79 (154,126), 0.84 (154, 126), and 1.06 (154, 126) for Asia and 0.81 (65,195), 1.38 (143, 117), 0.80 (143, 117), and 1.13 (143, 117) for Latin America.

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